Ever Analog

**Ultra Low Quiescent Current
1.2A Sync. Buck Converter**

EA8103
Datasheet

General Description

The EA8103 is a high switching frequency, high efficiency synchronous buck regulator, designed to operate from 2.6V to 6V input voltage range. Built-in low $R_{DS(ON)}$ high/low side Power-MOSFETS not only reduce external components and has up to 95% efficiency, ideal for 1.2A output current applications. The EA8103 is designed to take into account the light load mode operation and can provide high efficiency over a wide range of the load current. The internal compensation design not only allows users to more simplified application, and can reduce the cost of external components. The EA8103 is available in the SOT-23-5 package and easy to use.

Features

▶ 1uA Ultra Low Quiescent Current
▶ Built-in Low $R_{DS(ON)}$ Power-MOSFETS
▶ Efficiency Up to 96%
▶ 2.6V to 6V Input Voltage Range
▶ Adjustable Output Voltage Range as Low as to 1.13V
▶ Fixed 1.35MHz Switching Frequency
▶ 1.2A Continuous Load Current
▶ <1uA Shutdown Current
▶ PFM Mode Operation at Light Load
▶ Internal Compensation
▶ Cycle-by-Cycle Current Limit
▶ Short Circuit Protection
▶ OTP Protection
▶ Available in SOT-23-5 Package

Applications

▶ Battery Powered Devices
▶ Handheld Devices
▶ Wearable Devices.
▶ IOT

Pin Configurations

SOT-23-5

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Pin Description

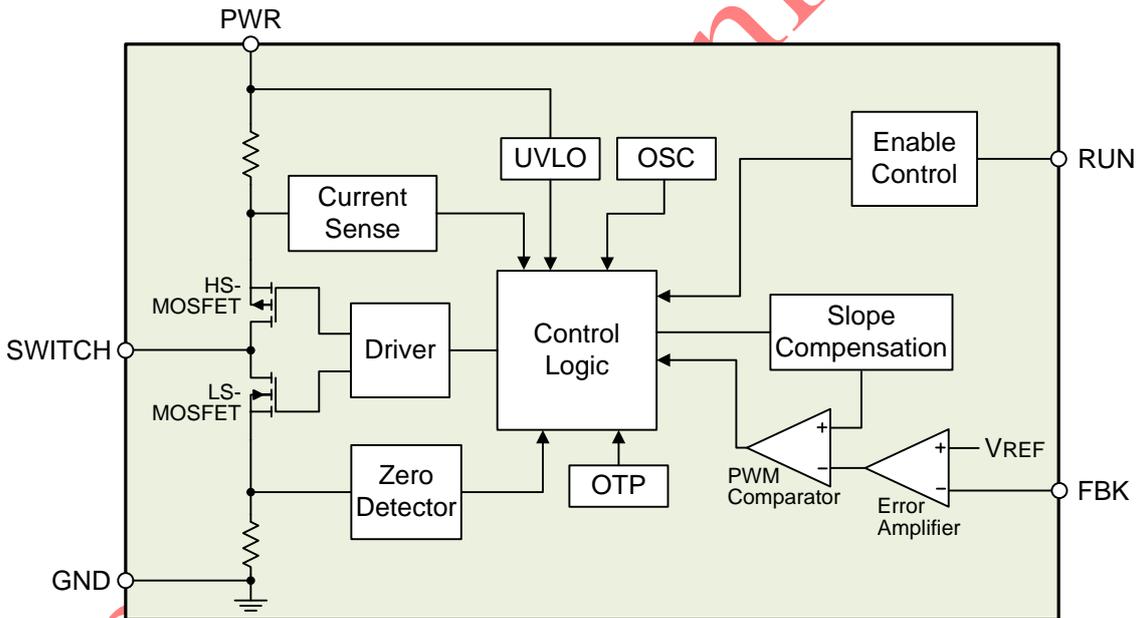| Pin Name	Function Description	Pin No.
RUN	The device turns on/turns off control input. Drive this pin above 1.5V to turn on, drive this pin below 0.4V to turn off. Don't leave this pin floating.	1
GND	Ground pin.	2
SWITCH	Power switch output pin. Connect SWITCH pin to the switching node of the inductor.	3
PWR	The EA8103 power input pin. It is recommended to use a 10uF 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.	4
FBK	Feedback input. Connect FBK pin and GND pin with voltage dividing resistors to set the output voltage.	5

Function Block Diagram

Figure 1. EA8103 internal function block diagram

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Absolute Maximum Ratings

Parameter	Value
Input Supply Voltage (V_{PWR})	-0.3V to +7V
RUN Pin Input Voltage (V_{RUN})	-0.3V to +7V
SWITCH Pin Voltage (V_{SWITCH})	-0.3V to (V_{PWR}+0.3V)
FBK Pin Voltage (V_{FBK})	-0.3V to +7V
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-23-5 Thermal Resistance (θ_{JC})	125°C/W
SOT-23-5 Thermal Resistance (θ_{JA})	250°C/W
SOT-23-5 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})	+2.6V to +6V
Junction Temperature Range (T_J)	-40°C to +125°C

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Electrical Characteristics

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage	V_{PWR}		2.6		6	V
Shutdown Supply Current	I_{SD}	V_{RUN} = 0V		0.1	1	uA
Quiescent Current	I_Q	V_{RUN} = 2V, V_{FB} = 1.2V		1		uA
UVLO Threshold	V_{UVLO}	V_{PWR} Rising	2.2	2.35	2.5	V
UVLO Hysteresis	V_{UV-HYS}			0.1		V
Output Load Current	I_{LOAD}				1.2	A
Reference Voltage	V_{REF}		1.107	1.13	1.153	V
Switching Frequency	F_{SW}	I_{LOAD} = 100mA		1.35		MHz
PMOS On-Resistance	$R_{DS(ON)-P}$	I_{LOAD} = 100mA		200		mΩ
NMOS On-Resistance	$R_{DS(ON)-N}$	I_{LOAD} = 100mA		300		mΩ
PMOS Current Limit	I_{LIM-P}		1.8	2.4		A
SWITCH Leakage Current	$I_{LEAK-SWITCH}$	V_{PWR} = 5V, V_{RUN} = 0V, V_{SWITCH} = 0V or 5V	-1		1	uA
FBK Leakage Current	$I_{LEAK-FBK}$	$V_{FB} = V_{PWR}$	-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
Input Over-Voltage Protection Threshold	V_{OVP}			7		V
Input Over-Voltage Protection Hysteresis	$V_{OVP-HYS}$			0.3		V
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.

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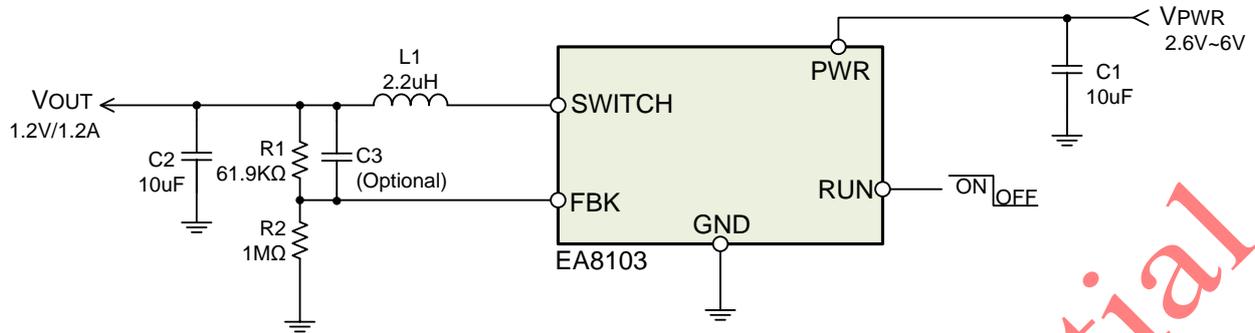## Application Circuit Diagram

Figure 2. Typical application circuit diagram

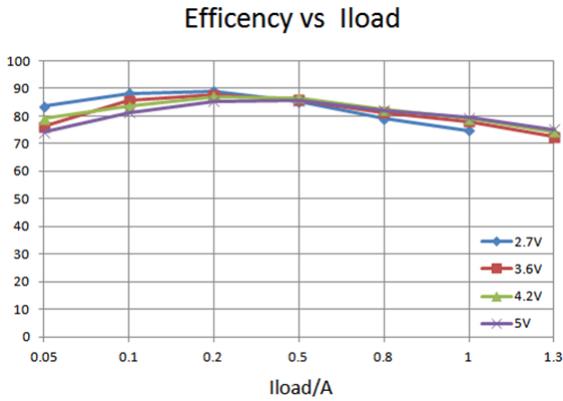## Ordering Information

Part Number	Package Type	Packing Information
EA8103T5R	SOT-23-5	Tape & Reel / 3000

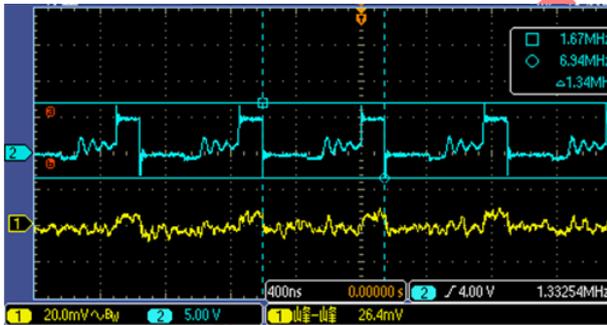Note (1):"T5": Package type code.

　　(2):"R": Tape & Reel.

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Typical Operating Characteristics

V_{PWR}=5V, V_{OUT}=1.2V, L1=2.2uH, C1=C2=10uF, T_A=25°C, unless otherwise noted

Efficency vs Iload

VOUT vs Iload
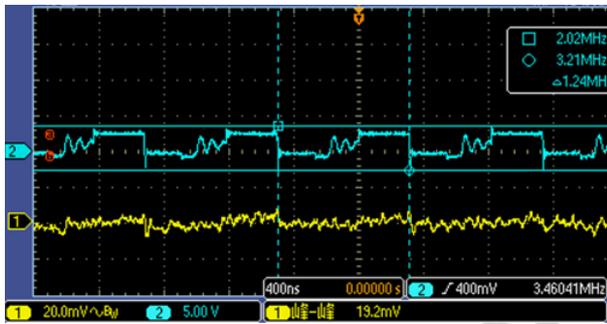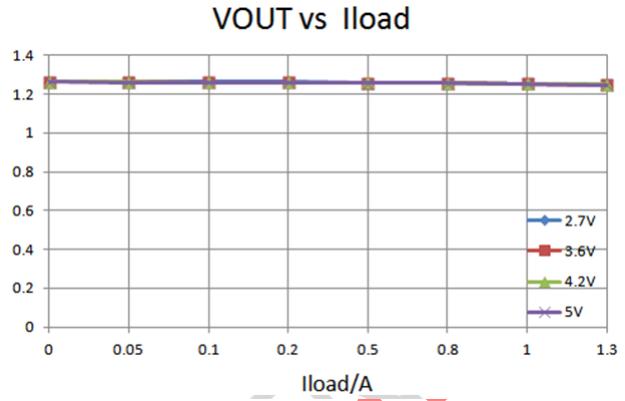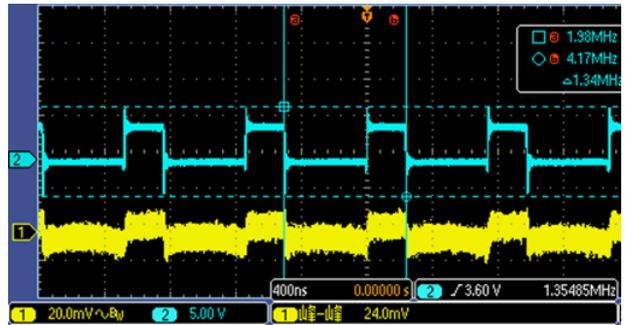

VIN = 2.7V, ILOAD = 0.1A Waveform
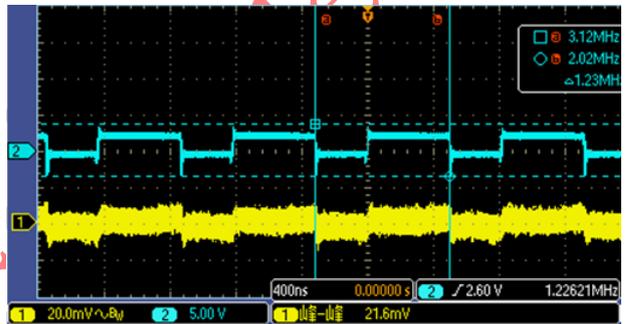
VIN = 2.7V, ILOAD = 1A Waveform

VIN = 5V, ILOAD = 0.1A Waveform

VIN = 5V, ILOAD = 1.2A Waveform

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Application Information

Output Voltage Setting

The EA8103 output voltage can be set via a resistor divider (R1, R2). The output voltage is calculated by following equation:

$$V_{OUT} = 1.13 \times \frac{R1}{R2} + 1.13 \text{ V}$$

The following table lists common output voltage and the corresponding R1, R2 resistance value for reference.

Output Voltage	R1 Resistance	R2 Resistance	Tolerance
3.3V	965KΩ	499KΩ	1%
1.8V	300KΩ	499KΩ	1%
1.5V	332KΩ	1MΩ	1%
1.2V	61.9KΩ	1MΩ	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. The suggested part numbers of input / output capacitors are as follows:

Vendor	Part Number	Capacitance	Edc	Parameter	Size
TDK	C2012X5R1A106K	10uF	10V	X5R	0805
TDK	C3216X7R1A106K	10uF	10V	X7R	1206

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:

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

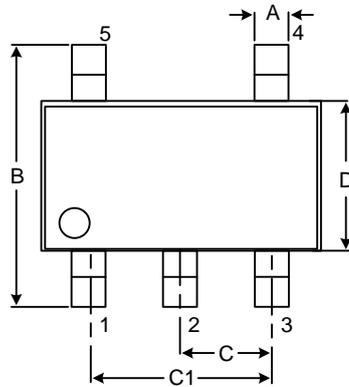For most applications, 1uH to 4.7uH inductors are suitable for EA8103.

PCB Layout Recommendations

For EA8103 PCB layout considerations, please refer to the following suggestions in order to get good performance.
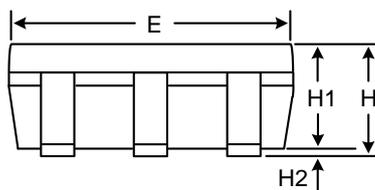
- ▶ High current path traces need to be widened.
- ▶ Place the input capacitors as close as possible to the PWR pin to reduce noise interference.
- ▶ Keep the feedback path (from V_{OUT} to FBK) away from the noise node (ex. SWITCH). SWITCH is a high current noise node. Complete the layout by using short and wide traces.

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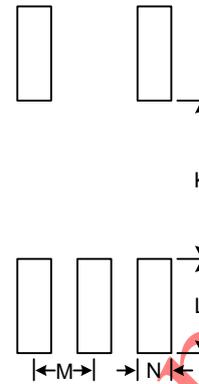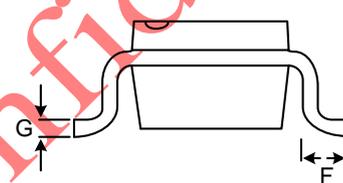### *1uA Ultra Low Quiescent Current 1.2A Sync. Buck Converter*

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Package Information

SOT-23-5 Package

Top View

Recommended Layout Pattern

Side View

Front View

Unit: mm

Symbol	Dimension		Symbol	Dimension
	Min	Max		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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