2A, 1.5MHz, High Efficiency Synchronous Buck Converter

EA8105

General Description

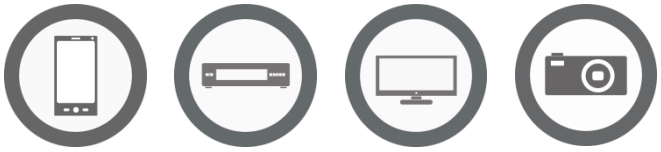
The EA8105 is a high switching frequency, high efficiency synchronous buck regulator, designed to operate from 2.7V to 5.5V input voltage range. Built-in low $R_{DS(ON)}$ high/low side Power-MOSFETS not only reduce external components and has up to 95% efficiency, ideal for 2A output current applications. The EA8105 features 100% duty cycle low dropout operation, extending battery life in portable systems. Besides, this device 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 EA8105 is available in the SOT-23-6 package and easy to use.

Features

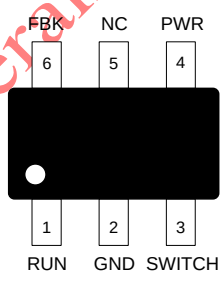
- Built-in Low $R_{DS(ON)}$ Power-MOSFETS
- Efficiency Up to 96%
- 2.7V to 5.5V Input Voltage Range
- Adjustable Output Voltage Range from 0.6V to Vin
- Fixed 1.5MHz Switching Frequency
- 2A Continuous Load Current
- 100% Duty Cycle Low Dropout Operation
- Internal Compensation
- Short Circuit Protection
- OTP Protection
- Available in SOT-23-6 Package

Applications

- Smart Phones
- Set-Top-Box
- LCD TVs and Flat TVs
- Digital Cameras



Pin Configurations



EA8105
SOT-23-6

Pin Description

Pin Name	Function Description	Pin No.
RUN	The device turns on/turns off control input. 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 EA8105 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.	4
NC	No Connect for EA8105.	5
FBK	Feedback input. Connect FBK pin and GND pin with voltage dividing resistors to set the output voltage.	6

Function Block Diagram

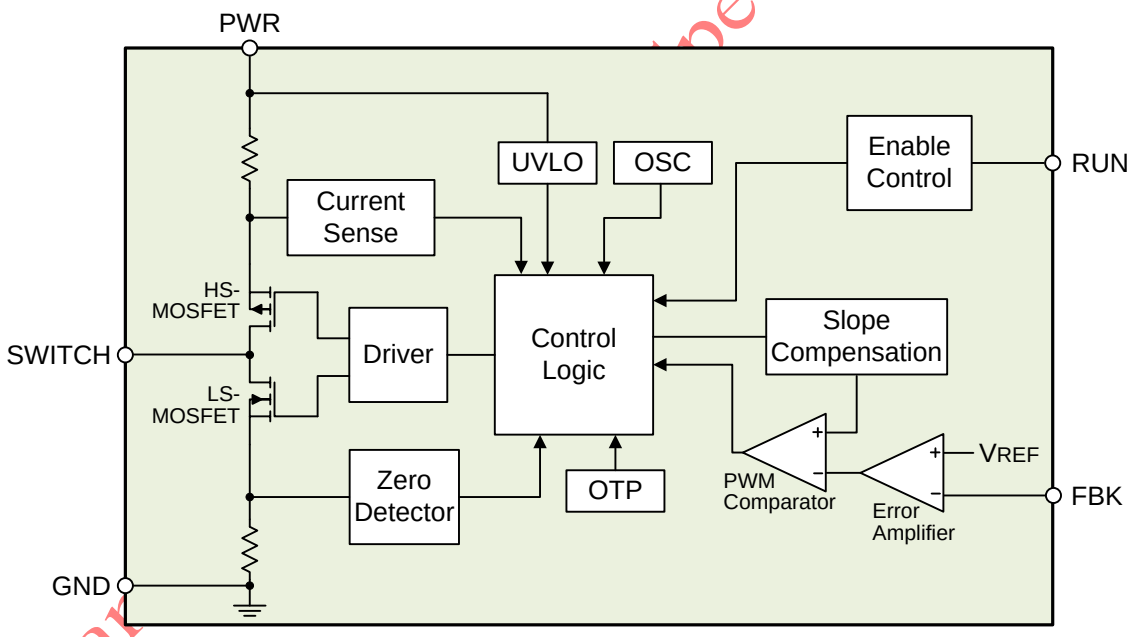


Figure 1. EA8105 internal function block diagram

Absolute Maximum Ratings

Parameter	Value
Input Supply Voltage (V_{PWR})	-0.3V to +6.5V
RUN Pin Input Voltage (V_{RUN})	-0.3V to +6.5V
SWITCH Pin Voltage (V_{SWITCH})	-0.3V to (V_{PWR}+0.3V)
FBK Pin Voltage (V_{FBK})	-0.3V to +6.5V
PG Pin Voltage (V_{PG})	-0.3V to +6.5V
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})	+2.7V to +5.5V
Junction Temperature Range (T_J)	-40°C to +125°C

Electrical Characteristics

V_{PWR}=3.6V, V_{OUT}=1.8V, T_A=25°C, unless otherwise noted

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage	V_{PWR}		2.7		5.5	V
Shutdown Supply Current	I_{SD}	V_{RUN} = 0V		0.1	1	uA
Quiescent Current	I_Q	V_{RUN} = 2V, V_{FBK} = 105% V_{REF}, I_{LOAD} = 0A		40	100	uA
UVLO Threshold	V_{UVLO}	V_{PWR} Rising	1.7	1.9	2.2	V
UVLO Hysteresis	$V_{UV-HYST}$			0.1		V
Output Load Current	I_{LOAD}				2	A
Reference Voltage	V_{REF}		0.588	0.6	0.612	V
Switching Frequency	F_{SW}	I_{LOAD} = 100mA	1.2	1.5	1.8	MHz
Short Frequency	F_{SHORT}	V_{OUT} = 0V	240	300	360	KHz
PMOS On-Resistance	$R_{DS(ON)-P}$	I_{LOAD} = 100mA		100		mΩ
NMOS On-Resistance	$R_{DS(ON)-N}$	I_{LOAD} = 100mA		90		mΩ
PMOS Current Limit	I_{LIM-P}		3	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
Power Good Rising Threshold	$V_{PG-rising}$			93		%
Power Good Falling Threshold	$V_{PG-falling}$			88		%
Power Good Sink Current	I_{PG}	V_{PG} = 0.5V		1		mA
Maximum Duty Cycle	D_{MAX}		100			%
Thermal Shutdown Threshold	T_{OTP}			150		°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

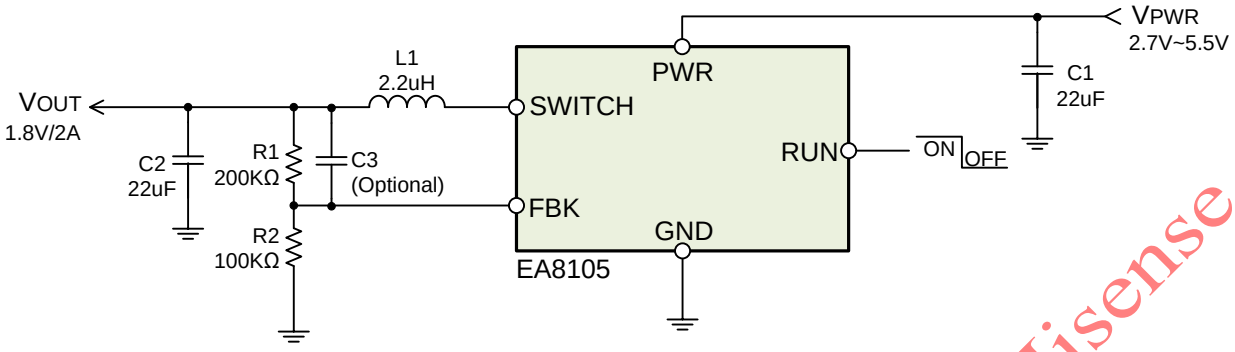


Figure 2. EA8105 typical application circuit diagram

Ordering Information

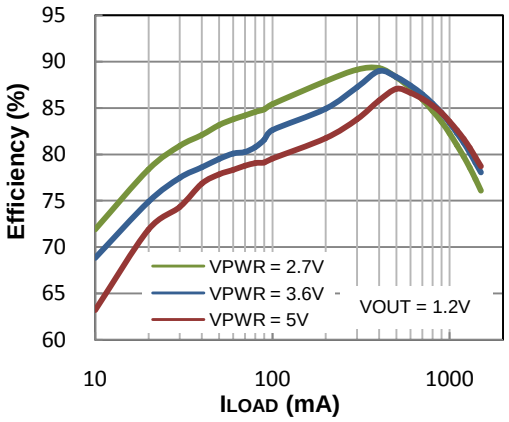
Part Number	Package Type	Packing Information
EA8105T6R	SOT-23-6	Tape & Reel / 3000

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

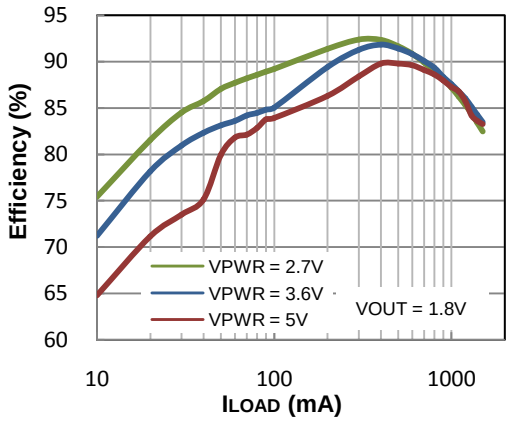
Typical Operating Characteristics

V_{PWR}=3.6V, V_{OUT}=1.2V, L1=2.2uH, C1=C2=22uF, T_A=25°C, unless otherwise noted

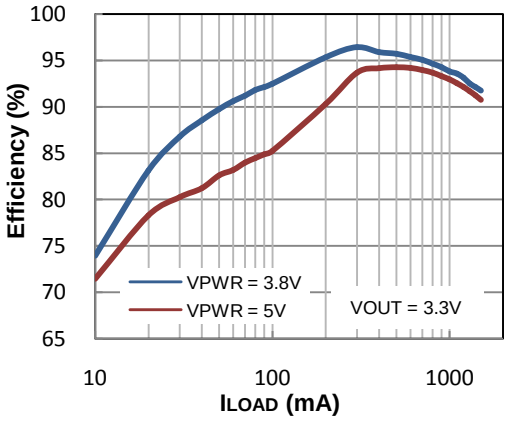
Efficiency vs. Load Current



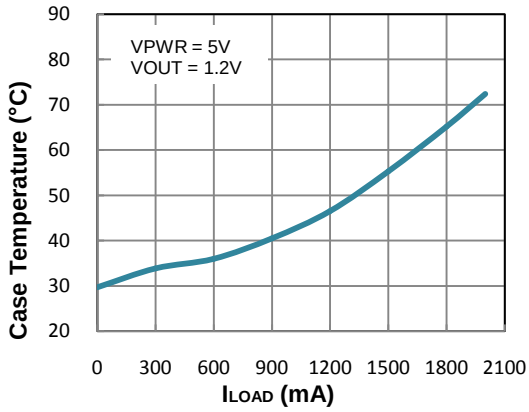
Efficiency vs. Load Current

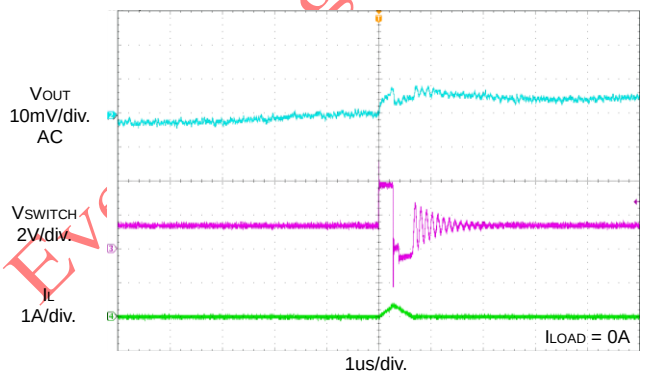


Efficiency vs. Load Current

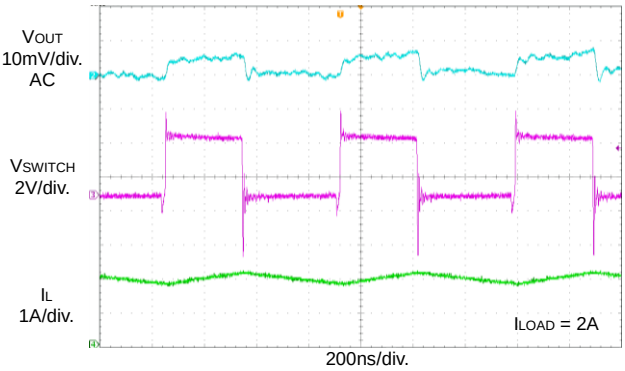


TC vs. Load Current





Steady State Waveform



Steady State Waveform

Application Information

Output Voltage Setting

The EA8105 output voltage can be set via a resistor divider (R1, R2). The output voltage is calculated by following equation:

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

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	510KΩ	110KΩ	1%
1.8V	200KΩ	100KΩ	1%
1.2V	100KΩ	100KΩ	1%
1V	68KΩ	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. The suggested part numbers of input / output capacitors are as follows:

Vendor	Part Number	Capacitance	Edc	Parameter	Size
TDK	C2012X5R1A226M	22uF	10V	X5R	0805
TDK	C3216X5R1A226M	22uF	10V	X5R	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, 1.2uH to 4.7uH inductors are suitable for EA8105.

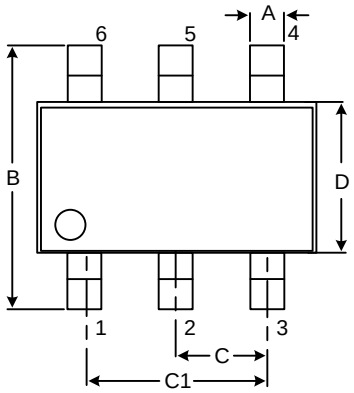
PCB Layout Recommendations

For EA8105 PCB layout considerations, please refer to the following suggestions in order to get good performance.

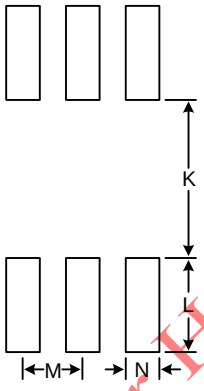
- High current path traces need to be widened.
- Place the input capacitors as close as possible to the PWR pin to reduce noise interference.
- Keep the feedback path (from V_{OUT} to FBK) away from the noise node (ex. SWITCH). SWITCH is a high current noise node. Complete the layout by using short and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

Package Information

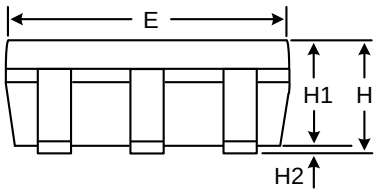
SOT-23-6 Package



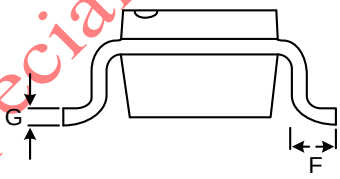
Top View



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		