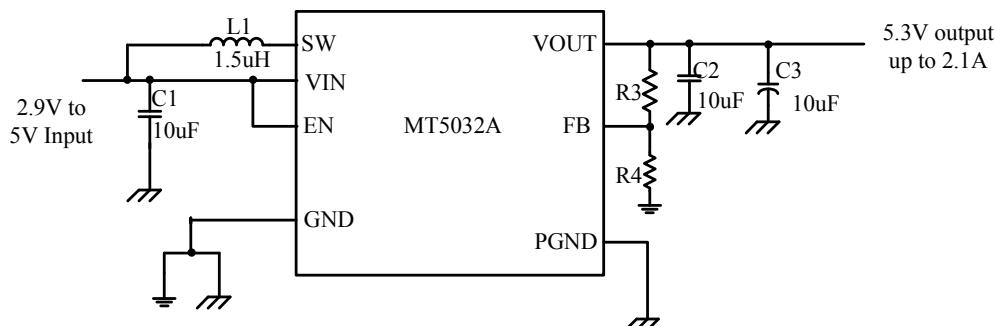## DESCRIPTION

The MT5032A devices provide a power supply solution for products powered by either a one-cell Li-Ion or Li-polymer battery. The converter generates a stable output voltage that is either adjusted by an external resistor divider or fixed internally on the chip. It provides high efficient power conversion and is capable of delivering output currents up to 2.1A at 5V at a supply voltage down to 3V. The maximum peak current in the step-up switch is limited to a value of 5.5A. The MT5032A operates at 800kHz switching frequency and enters pulse-skip-mode (PSM) operation at light load currents to maintain high efficiency over the entire load current range. During shutdown, the load is completely disconnected from the battery.

FEATURES

- Synchronous Step-up Converter with 2.1A Output Current From 3V Input
- Wide V_{IN} Range From 2.9V to 5.5V
- Input Under-voltage Lockout Protection
- Fixed and Adjustable Output Voltage
- Built-in Output Over-voltage Protection
- Light-Load Pulse Skip Mode
- Load Disconnect During Shutdown
- Output Short Circuit Protection
- Thermal Shutdown Protection
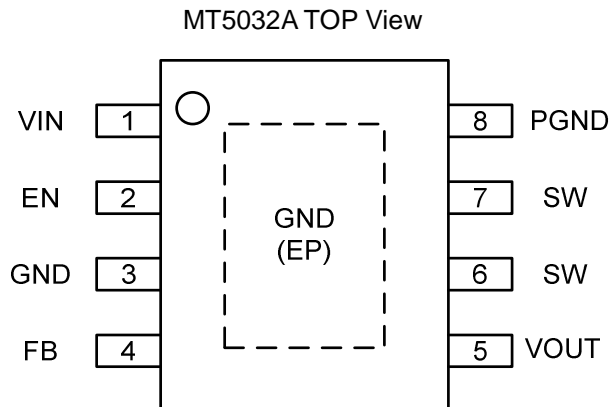- Available in a SOP8_EP Packages

APPLICATIONS

- Power Bank
- USB Charging Port (5V)
- DC/DC Micro Modules

Figure 1. MT5032A Typical Application Circuit

800kHz Synchronous Step-up Converter with 5.5A Switches

Ordering Information

Part No.	Marking	Temp. Range	Package	Remark
MT5032ANSPR	MT5032A xxxxx	-40℃ ~+85℃	SOP 8L 150 mils (EP)	

Pin Configuration

MT5032A TOP View

Pin Description

NAME	PIN NO.	DESCRIPTION
VIN	1	Input Supply voltage
EN	2	Enable input. (1/VIN enabled, 0/GND disabled)
GND	3	Analog Ground pin. Connect GND to PGND under EP.
FB	4	Voltage feedback of adjustable versions. Connect FB to GND and set fixed 5.1V output voltage.
VOUT	5	Step-up convert output
SW	6, 7	Step-up and rectifying switch input
PGND	8	Power Ground pin.
EP		Exposed pad must be soldered to achieve appropriate power dissipation. Connect EP to GND.

Absolute Maximum Rating (1)

Supply Voltage (V$_{IN}$) ………………….. -0.3V to +6V   Lead Temperature…..…………………………………260℃

Output Voltage (V$_{OUT}$) ………………….. -0.3V to +6V   Junction temperature range, T$_J$ ……. -40℃ ~+135℃

Input Voltage (EN, FB, SW) ……..…… -0.3V to +6V   Storage temperature range, T$_{stg}$ …… -55℃~+155℃

Peak Output Current ……………….. Internally limited

Thermal Information

Maximum Power Dissipation(T$_{A=}$+25℃) …… 2.6W   SOP8 EP Thermal resistance(θ$_{JA}$) ……… 38.2℃/W

Recommend Operating Conditions (2)

Input Voltage (V$_{IN}$) …………………… +2.9V to +5.5V   Operating Temperature Range …… -40℃ to +85℃

Output Voltage (V$_{OUT}$) ……………….. +2.9V to +5.5V

Note (1): Stress beyond those listed under "Absolute Maximum Ratings" may damage the device.

Note (2): The device is not guaranteed to function outside the recommended operating conditions.

Electrical Characteristics

T$_A$ = +25℃, 2.9V ≤ V$_{IN}$ ≤ 5.5V, unless otherwise noted. Typical values are at V$_{IN}$= V$_{EN}$ =3.6V and V$_{OUT}$=5V.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input voltage range V$_{IN}$		2.5		5.5	V
Input Under-voltage Lockout Threshold V$_{UVLO}$			2.2		V
Output voltage adjustable range V$_{OUT}$		2.5		5.5	V
Fixed Output Voltage	FB=GND	4.95	5.10	5.25	V
Feedback voltage V$_{FB}$		490	500	510	mV
Oscillator frequency f$_{OSC}$		640	800	960	kHz
NCH Switch Current Limit	V$_{OUT}$= 5V		5.5		A
NCH Switch on resistance	V$_{OUT}$= 5V		75		mΩ
PCH Switch on resistance	V$_{OUT}$= 5V		75		mΩ
Shutdown Current	V$_{EN}$ = 0V, V$_{IN}$ = 3.6V		0.1	1	µA

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Quiescent Current	V_{IN}	V_{FB} =0.55V , V_{OUT}=5V		125	200	μA
EN logic low voltage					0.4	V
EN logic high voltage			1.4			V
EN leakage current		Clamped on GND or V_{IN}	-1		1	μA
Thermal Shutdown				150		℃
Thermal Shutdown Hysteresis				20		℃

Functional Block Diagram
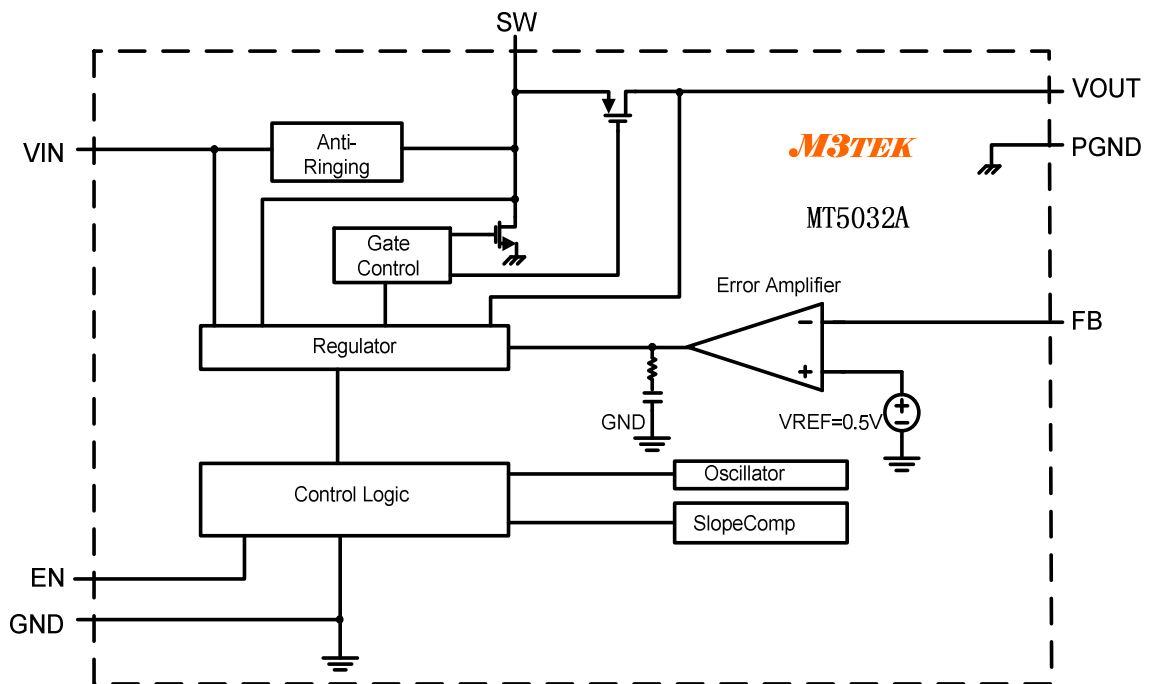
Figure 2. MT5032A Functional Block Diagram

TYPICAL PERFORMANCE CHARACTERISTICS

V_{IN} = 3.3V, MT5032A typical application circuit (Figure 1.), TA = +25℃, unless otherwise noted.

Efficiency vs. Load Current

Steady State
V_{IN}=3.3V, V_{OUT}=5.0V, I_{LOAD}=0A

Steady State
V_{IN}=3.3V, V_{OUT}=5.0V, I_{LOAD}=0.1A

Steady State
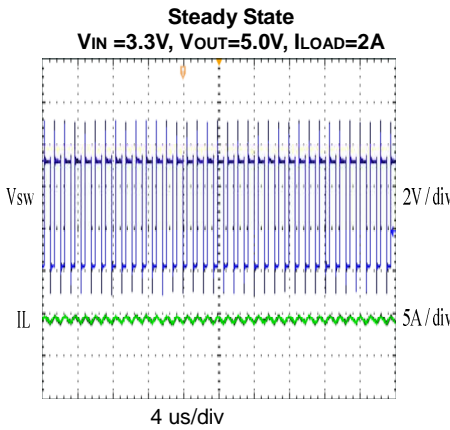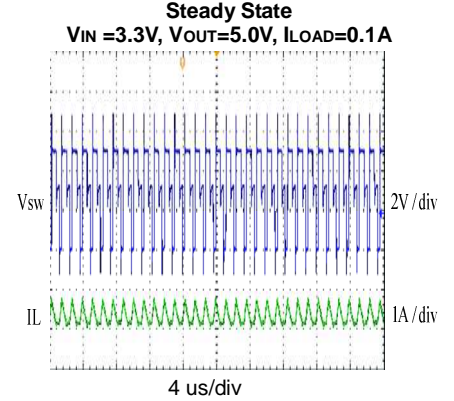**V_{IN} =3.3V, V_{OUT}=5.0V, I_{LOAD}=2A**

Steady State
V_{IN}=4.19V, V_{OUT}=5.0V, I_{LOAD}=0.05A

Startup from Enable
Vin=3.3V, Vout=5.0V, Iload=1.5A

Short Circuit
V_{IN} =3.3V, V_{OUT}=5V,
I_{LOAD}=0.3A to Short Circuit

Shutdown from Enable
V_{IN} =3.3V, V_{OUT}=5.0V,
I_{LOAD}=1.5A

Load Transient
V_{IN} =3.3V, V_{OUT}=5.0V,
I_{LOAD}=0.2A~1.8A
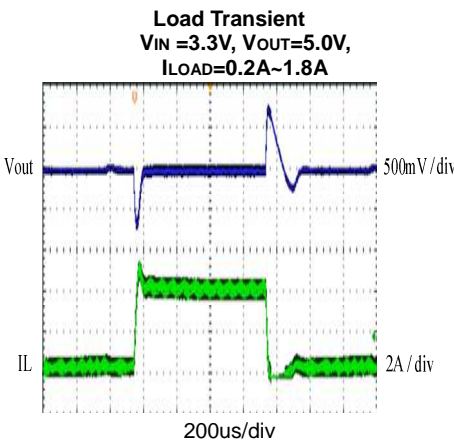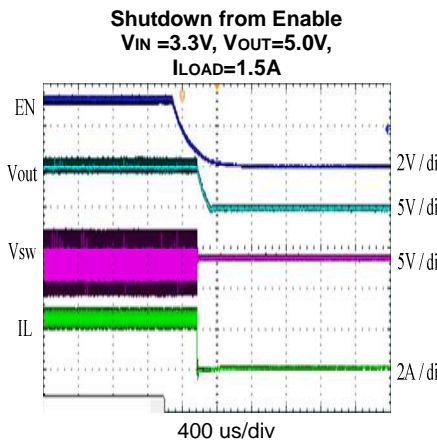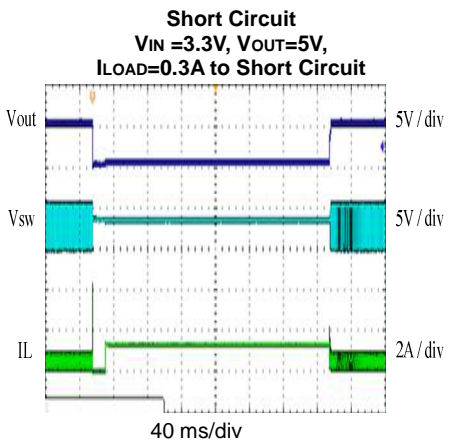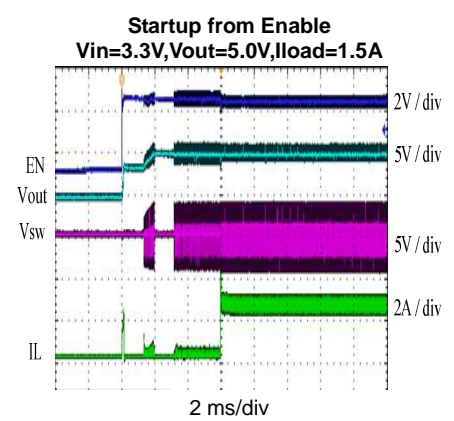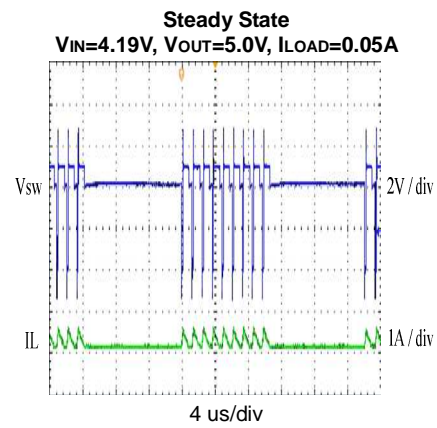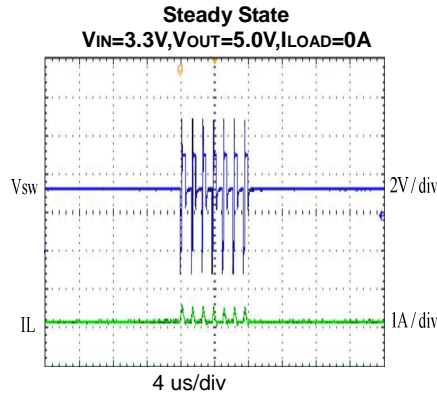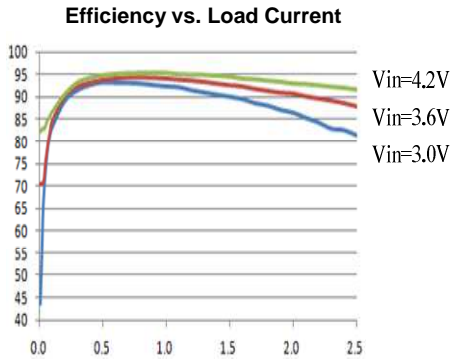
Detailed Description

The MT5032A is based on a fixed frequency current mode pulse width modulation topology. The peak current of the NMOS switch is sensed to limit the maximum current flowing through the switch and the inductor. The typical peak current limit is set to 5.5A. An internal temperature sensor prevents the device from getting overheated in case of excessive power dissipation.

Application Information

Because of the high integration of MT5032A, the application circuit is simple. Only input capacitor CIN, output capacitor COUT, inductor L, output feedback resistors R3, R4 need to be selected for the targeted applications specifications.

Setting the Output Voltage

The MT5032Aoutput voltage can be adjusted with an external resistor divider (See Figure 1). The typical value of the voltage on the FB pin is 500mV. The maximum allowed value for the output voltage is 5.5 V. Choose the bottom resistor R4 in the 100kΩ~500kΩ range to set the divider current at 1 µA or higher. The value of resistor R3, depending on the needed output voltage V_{OUT}, can be calculated using Equation 1:

$$R3 = R4 \times \left(\frac{V_{OUT}}{V_{FB}} - 1 \right) = 200k\Omega \times \left(\frac{V_{OUT}}{500mV} - 1 \right) \quad \text{(Equation 1)}$$

Inductor Selection

The MT5030A 800kHz high switching frequency allows for the use of small surface mount inductors. For high efficiency, choose inductors with high frequency core material, such as ferrite, to reduce core losses. Also to improve efficiency, choose inductors with bigger size for a given inductance. The inductor should have low DCR (copper-wire resistance) to reduce I2R losses, and must be able to handle the peak inductor current without saturating. The inductor DC current rating should be greater than the maximum input average current. For the full 2Amp output current applications, the inductor shall have enough core volume to support peak inductor currents in the 4A to 7A range and DCR less than 10mΩ. The highest peak current through the inductor and the switch depends on the output load, converter efficiency η, the input voltage (V_{BAT}), and the output voltage (V_{OUT}). Estimation of the maximum average inductor current can be done using Equation 3:

$$I_L = I_{OUT} \times \frac{V_{OUT}}{V_{BAT} \times \eta} \quad \text{(Equation 3)}$$

For example, for an output current of 2A at 5V with 85% efficiency, at least 4.7A of average current flows through the inductor at a minimum input voltage of 2.9V.

The MT5030 step-up converters can operate with an effective inductance in the range of 1µH to 2.2µH and with output capacitors in the range of 20µF to 100µF. The internal compensation is optimized for an output filter of L = 1.5µH and C_{OUT} = 20µF. To minimize radiated noise, use a toroidal or shielded inductor.

Input Capacitor

Place at least a 10 µF input ceramic capacitor close to the IC is to improve transient behavior of the regulator and EMI behavior of the total power supply circuit.

Output Capacitor

The output capacitor must completely supply the load during the charging phase of the inductor. A reasonable value of the output capacitance depends on the speed of the load transients and the load current during the load change. It is recommended to use X7R ceramic capacitors placed as close as possible to the VOUT and PGND pins of the IC. A recommended output capacitance value is around 20~100µF. Note that high capacitance ceramic capacitors have a DC Bias effect, which will have a strong influence on the final effective capacitance. A 10 V rated 0805 capacitor with 10µF can have an effective capacitance of less 5µF at an output voltage of 5V.

Layout consideration

Use wide and short traces for the main current path and for the power ground tracks. The input capacitor, output capacitor, and the inductor should be placed as close as possible to the IC. Use a common ground node for power ground and a different one for analog ground to minimize the effects of ground noise. Connect these ground nodes at any place close to the ground pins of the IC.

Thermal information

Implementation of integrated circuits in low-profile and fine-pitch surface-mount packages typically requires special attention to power dissipation. Many system-dependent issues such as thermal coupling, airflow, added heat sinks and convection surfaces, and the presence of other heat-generating components affect the power-dissipation limits of a given component.

Three basic approaches for enhancing thermal performance are listed below:

- High speed switching path (SW, PGND and VOUT with wide PCB traces) must be kept as short as possible.
- Solder the exposed pad of the MT5030A to the ground plane with multiple big thermal vias.
- Choose a bigger size 1.5uH Inductor with the lowest DCR value for given PCB space

The maximum junction temperature (T_J) of the MT5032A devices is 125℃.The thermal resistance of the SOP8_EP package is $R_{\theta JA}$ = 38.2℃/W, if the Exposed PAD is soldered. Specified regulator operation is assured to a maximum ambient temperature T_A of +50℃. Therefore, the maximum power dissipation for the SOP8_EP package it is about 1.96W. More power can be dissipated if the maximum ambient temperature of the application is lower.

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{R_{\theta JA}} = \frac{125°\text{C-}50°C}{38.2°\text{C}/W} = 1.96W$$

800kHz Synchronous Step-up Converter with 5.5A Switches

PACKAGING INFORMATION

MT5032A SOP 8L 150 mils(EP) Package Outline Dimensions
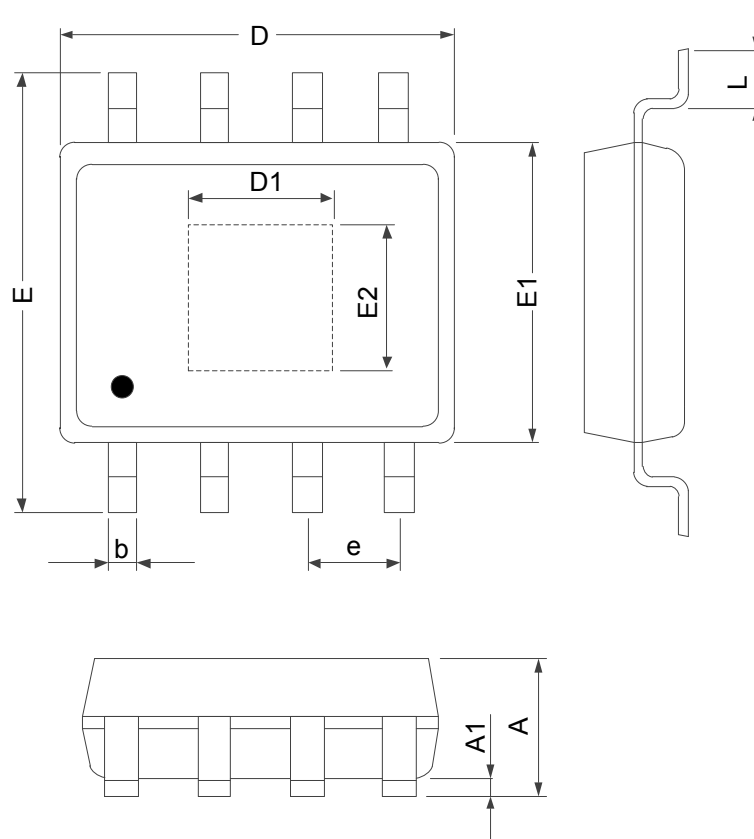
SYMBOLS	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.90		0.193	
E1	3.90		0.153	
D1	2.00		0.081	
E2	2.00		0.081	
E	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
b	0.31	0.51	0.012	0.020
e	1.27		0.050	

Datasheet Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0.1	2013/09/25	Initial release	—