Two-Channel Power Management Unit
A 500mA Step-Up Converter and A 300mA LDO in SOP8

FEATURES

- Consists of A low Start-up Boost and a high PSRR LDO
- Low Vin Start-up Voltage down to 850mV Ideal for Single Alkaline Cell operations
- A Step-up capable of delivering 500mA output current at Vin=3.0V, V out=3.3V
- 1MHz Switching Frequency allows small inductor and output cap
- High PSRR LDO: 74dB
- LDO output current up to 300mA
- Logic Control Shutdown (IQ<1uA)
- Available in SOP-8

APPLICATIONS

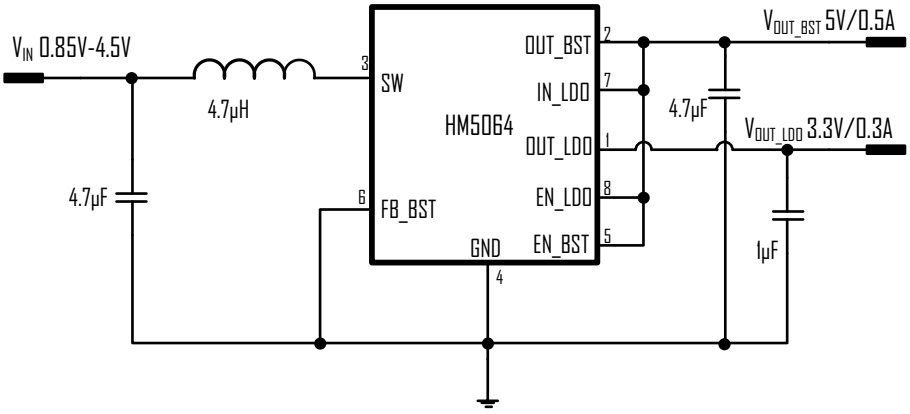
- Medical Instruments
- Bluetooth Headsets
- Flash-Based MP3 Players
- Wireless Mice
- One to Three Cell Battery Operated Devices

DESCRIPTION

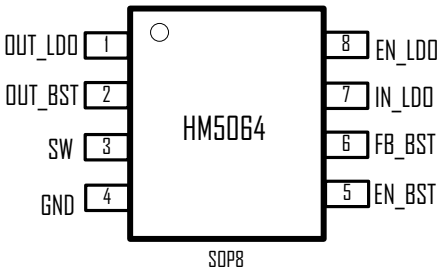
The HM5064 is a tow-channel power management unit that consists of a step-up converter capable of delivering 500mA output current and a high PSRR 300mA LDO. The step-up converter can be bootstrapped from a low voltage source and generate output voltage up to 5V. It starts up at a very low input voltage down to 850mV, making it an ideal choice for single cell alkaline/NiMH battery operations. The input of the LDO can be connected to the output of the step-up converter. This configuration is therefore an effective way of generating an output that is higher or lower than the input voltage, in other words, a buck-boost converter. Since the output is step-down from a LDO, its ripple is much superior to that of traditional switching buck-boost converters.

A switching frequency of 1MHz minimizes solution footprint by allowing the use of tiny, low profile inductors and ceramic capacitors. Eliminating the need for Tantalum caps not only saves cost, it is also environmental friendly.
HM5064 is housed in a SOP8 package.

TYPICAL APPLICATION



PIN CONFIGURATION



SOP8

ABSOLUTE MAXIMUM RATINGS

(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

ALL Pins Voltage .....–0.3V to 5.5V
Junction to Ambient Thermal Resistance.....90°C/W
Maximum Power Dissipation..... 1W
Operating Temperature Range ..... –40°C to 85°C
Storage Temperature Range ..... –55°C to 150°C

ORDERING INFORMATION

PART	Output Voltage (BST/LDO)	PACKAGE PIN	TOP MARK
HM5064	5V/3.3V	SOP8	ETA9040

ELECTRICAL CHACRACTERISTICS

(V_{IN} = 3.3V, V_{OUT_BST} = 5V, unless otherwise specified. Typical values are at TA = 25oC.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
STEP-UP					
Minimum Input Voltage			0.7		V
Startup Voltage			0.85	1.1	V
Output Voltage	FB_BST=OUT_BST	3.23	3.3	3.36	V
	FB_BST=GND	4.90	5	5.10	
FB_BST Feedback Voltage	V_{OUT_BST} =2.5 to 5V		0.6		V
FB_BST Input Current				50	nA
Output Voltage Range	External divider	2.5		5	V
Quiescent Current at OUT_BST	V_{FB}=0.7V		50		μA
Shutdown Supply Current at OUT_BST	EN_BST=GND		0.1	1	μA
Switching Frequency			1.5		MHz
NMOS Switch On Resistance	I_{SW} =100mA		0.3		Ω
PMOS Switch On Resistance	I_{SW} =100mA		0.6		Ω
NMOS Switch Current Limit		1			A
SW Leakage Current	V_{OUT_BST} = 5.5V, V_{SW}= 0 or 5.5V, EN=G			1	μA
LDO					
Input Voltage		2.5		6	V
LDO Output Voltage		3.234	3.3	3.366	V
Output Max Current		300			mA
LDO Dropout Voltage	I_{OUT}=100mA		115		mV
IN_LDO Quiescent Current	V_{IN_LDO}=5V		30	60	μA
LDO Input Shutdown Current			0.1	1	μA
PSRR	100Hz		74		dB

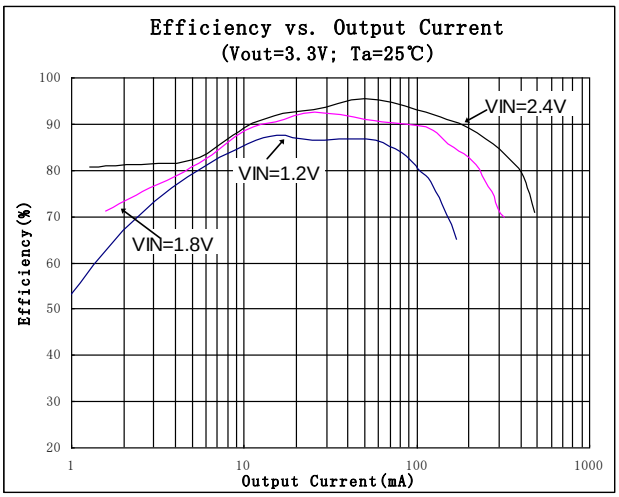
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
EN_ Input Current				1	μA
EN_ Input Low Voltage				0.3	V
EN_BST Input High Voltage		0.6			V
EN_LDO Input High Voltage		1			V

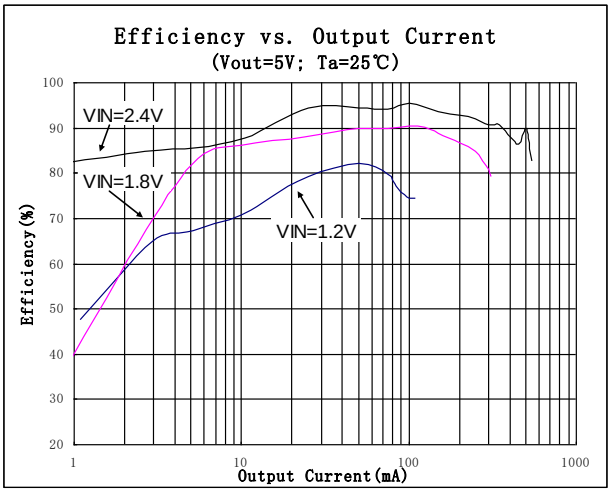
PIN DESCRIPTION

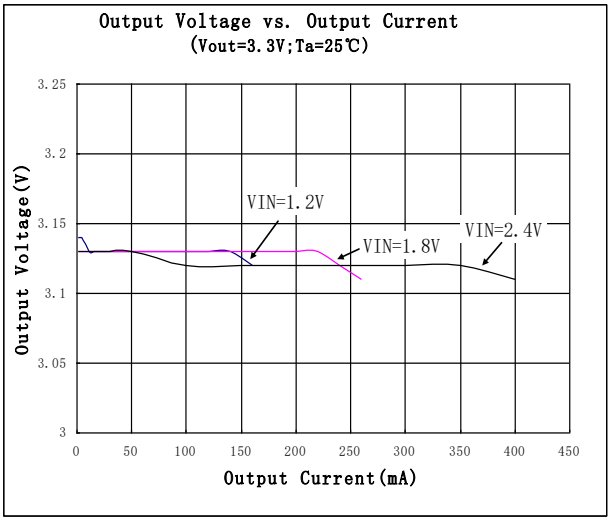
PIN #	NAME	DESCRIPTION
1	OUT_LDO	LDO Output Pin. Bypass OUT_LDO to GND with a minimum of 1μF ceramic capacitor
2	OUT_BST	Boost Output Pin. OUT_BST also provides power to the IC itself.
3	SW	Boost Switch Pin. Connect an inductor between this pin and IN. Minimize the metal trace area connected to this pin to minimize EMI.
4	GND	Ground. Tie this pin directly to the local ground plane.
5	EN_BST	Enable Pin for Boost. Tie this pin to 0.6V or higher to enable the device. Tie below 0.3V to turn off the device.
6	FB_BST	Boost output Voltage Selection and Feedback Input. Connect this pin to GND for VOUT_BST= 5V, to OUT_BST for VOUT_BST= 3.3V. Connect FB_BST to a resistor divider to set the output voltage using the following equation, V out= 0.6V(1+R1/R2)
7	IN_LDO	Input Pin for LDO power. Tie to OUT_BST for Buck-boost action or low noise output. It can also be supplied by a different voltage supply
8	EN_LDO	Enable Pin for LDO. Tie this pin to 1V or higher to enable the device. Tie below 0.3V to turn off the device.

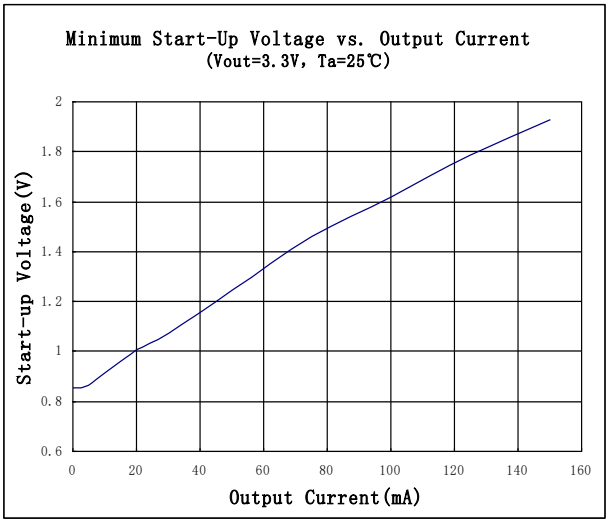
TYPICAL CHARACTERISTICS

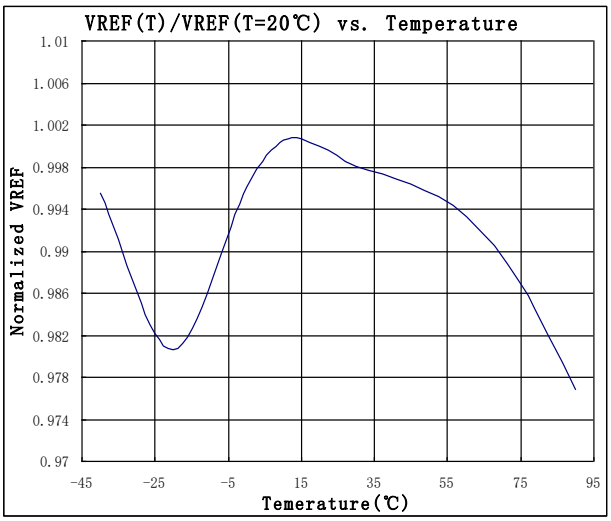
(Typical values are at TA = 25oC unless otherwise specified..)

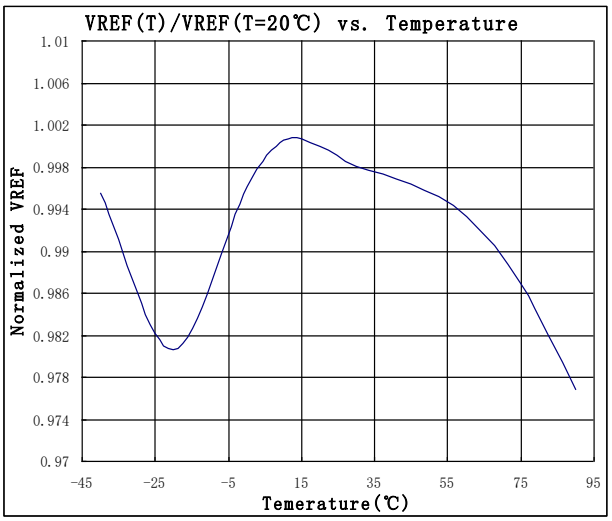


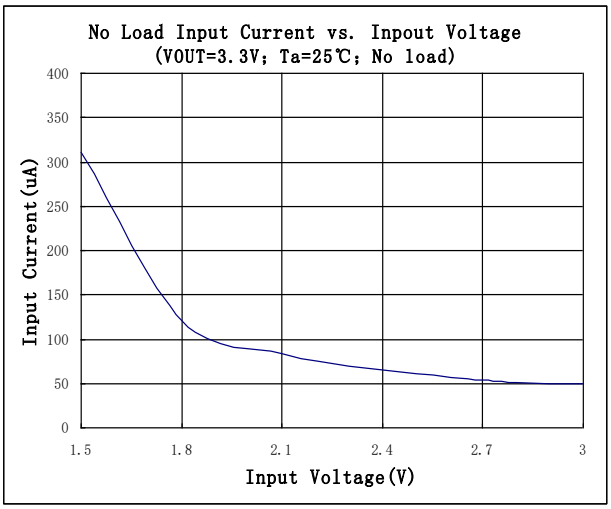


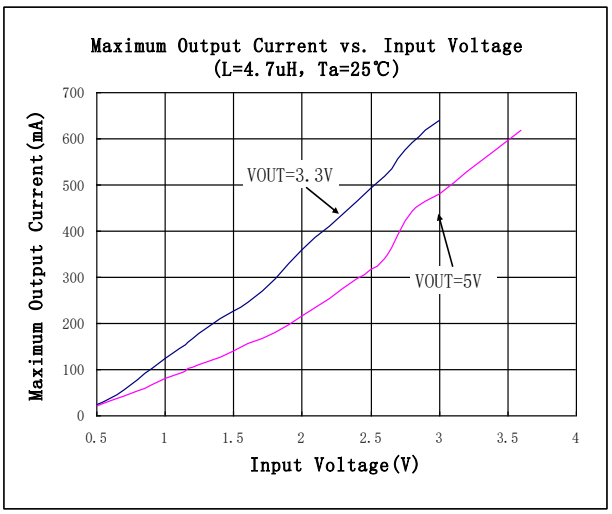

Output Voltage vs. Output Current
(Vout=3.3V;Ta=25℃)
Output Voltage(V)
3.25
3.2
3.15
3.1
3.05
3
VIN=1.2V
VIN=1.8V
VIN=2.4V
0
50
100
150
200
250
300
350
400
450
Output Current(mA)


Minimum Start-Up Voltage vs. Output Current
(Vout=3.3V, Ta=25℃)
Start-up Voltage(V)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0
20
40
60
80
100
120
140
160
Output Current(mA)


VREF(T)/VREF(T=20℃) vs. Temperature
Normalized VREF
1.01
1.006
1.002
0.998
0.994
0.99
0.986
0.982
0.978
0.974
0.97
-45
-25
-5
15
35
55
75
95
Temerature(℃)


VREF(T)/VREF(T=20℃) vs. Temperature
Normalized VREF
1.01
1.006
1.002
0.998
0.994
0.99
0.986
0.982
0.978
0.974
0.97
-45
-25
-5
15
35
55
75
95
Temerature(℃)


No Load Input Current vs. Inpout Voltage
(VOUT=3.3V; Ta=25℃; No load)
Input Current(uA)
400
350
300
250
200
150
100
50
0
1.5
1.8
2.1
2.4
2.7
3
Input Voltage(V)


Maximum Output Current vs. Input Voltage
(L=4.7uH, Ta=25℃)
Maximum Output Current(mA)
700
600
500
400
300
200
100
0
VOUT=3.3V
VOUT=5V
0.5
1
1.5
2
2.5
3
3.5
4
Input Voltage(V)

DETAIL DESCRIPTION

HM5064's boost operation can be best understood by referring to the block diagram. Upon starting up, the low voltage startup circuitry drives SW with on-off cycles, transferring energy from input to OUT_BST by storing energy in the inductor during on-time and releasing it to the output during off-time. When OUT_BST reaches 2V, the startup circuit turns off and the main controller takes over. The main control loop consists of a reference, a GM error amplifier, a PWM controller, a current sense amplifier, an oscillator, a PWM logic control, and it is power stage including its driver. The main control loop is a classic current mode control loop. The GM stage integrates the error between FB_BST and REF, and its output is used to compare with a triangular wave which the summing result of the current sense amplifier output and a slope compensation voltage. The output of the comparator is used to drive the power stage to reach regulation.

The LDO of HM5064 also consists of a low noise bandgap reference an high PSRR error amplifier. It also has output current limit protection and thermal protection.

The input of the LDO can be connected to the output of the boost for buck-boost conversion, but it can also be connected to a different power supply on system to provide a low noise output.

APPLICAITION INFORMATION

Boost Output Voltage Selection

The output voltages can be set by connecting FB_BST to OUT_BST, to G or to the midpoint of a resistor divider connected to OUT. See below table for details.

FB_BST=GND	V_{OUT_BST}=5.0V
FB=OUT_BST	V_{OUT_BST}=3.3V
FB_BST to resistor divider	V_{OUT_BST}=0.6V(1+R1/R2)

Boost Inductor selection

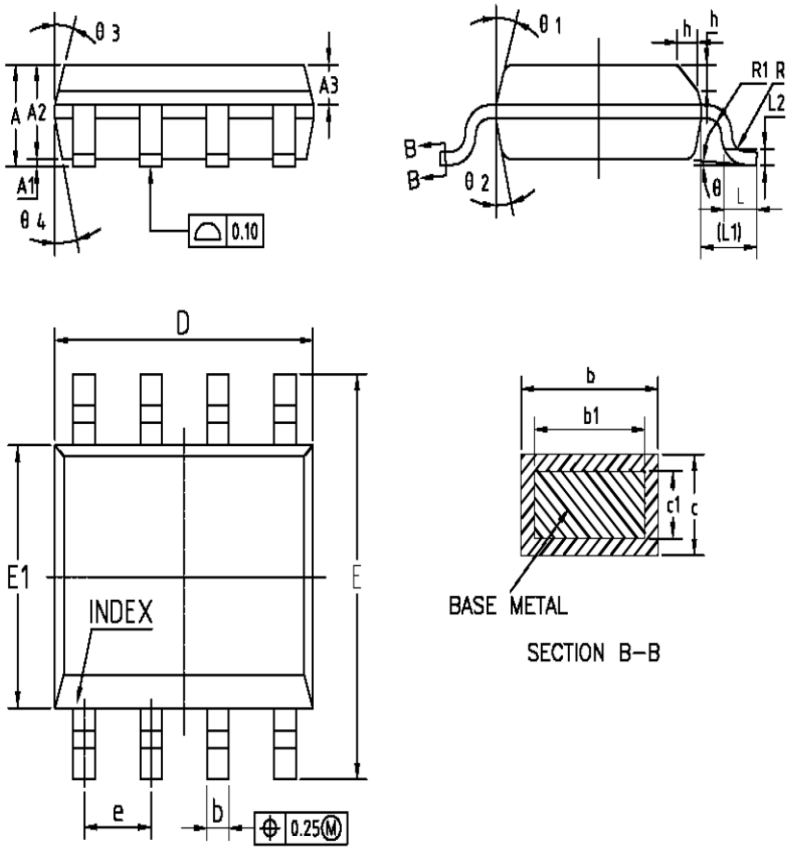
With switching frequency up to 1MHz, small surface mount inductors can be used with values from 2.2uH to 4.7uH. For a given chosen inductor value and application conditions make sure the peak inductor current does not exceed the maximum current rating of the selected vendor's inductor.

Input and output capacitor selection

The HM5064's bootstrap architecture allows the use of very small input capacitors. For applications that only need to drive small output load current, the input capacitor is optional, because once output is started up, the IC's is powered by OUT_BST, a quiet power supply.

The output capacitor is used to stabilize the loop and provide ac current to the load. A low ESR ceramic cap with values from 2.2uF to 22uF can be used. Smaller value capacitors are generally cheaper with small footprints, while larger capacitor provides lower ripples and better transient load responses. Also, when extreme low startup voltage is needed, larger output capacitors are needed for the part to startup under heavy load condition.

PACKAGE OUTLINE



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	–	0.51
b1	0.37	0.42	0.47
2 c	0.17	–	0.25
2 c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
R	0.07	–	–
R1	0.07	–	–
h	0.30	0.40	0.50
θ	0°	–	8°
θ 1	15°	17°	19°
θ 2	11°	13°	15°
θ 3	15°	17°	19°
θ 4	11°	13°	15°