DESCRIPTION

The A7533 is a step-up converter that provides a boosted output voltage from a low voltage source. Because of its proprietary design, it starts up at a very low input voltage down to 850mV, making it an ideal choice for single cell alkaline/NiMH battery operations.

A switching frequency of 1MHz minimizes solution footprint by allowing the use of tiny, low profile inductors and ceramic capacitors. The current mode PWM design is internally compensated, reducing external parts count.

The A7533 is available in SOT-25 Package.

ORDERING INFORMATION

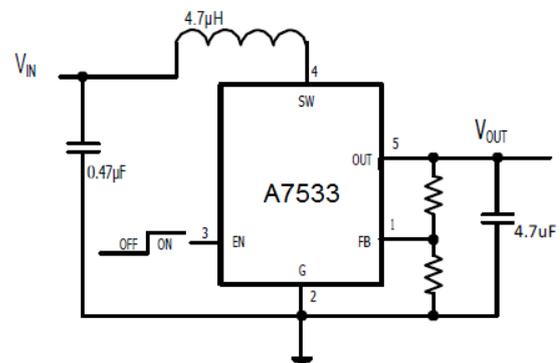| Package Type	Part Number	
SOT-25 SPQ: 3,000pcs/Reel	E5	A7533E5R-XXX
		A7533E5VR-XXX
Note	XXX: Output Voltage ADJ=Adjust V: Halogen free Package R : Tape & Reel	
AiT provides all RoHS products		

FEATURES

- Low Vin Start-up Voltage down to 850mV Ideal for Single Alkaline Cell operations
- Capable of delivering 500mA output current at Vin=3.0V, V out=3.3V
- 1MHz Switching Frequency allows small inductor and output cap
- Input boost-strapping allows using small or no input cap
- Low Noise PWM control
- Internally Compensated Current Mode Control
- Internal Synchronous Rectifier
- Logic Control Shutdown (I_Q<1uA)
- Available in SOT-25 Package.
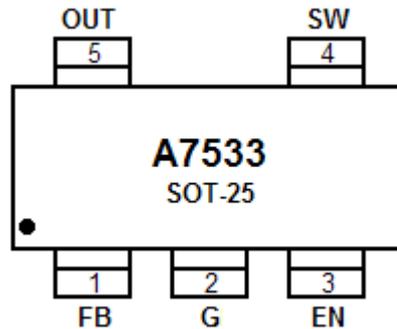
APPLICATION

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

TYPICAL APPLICATION

PIN DESCRIPTION

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        OUT              SW
         5                4

              A7533
              SOT-25

         1       2        3
        FB       G       EN
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Top View

Pin #	Symbol	Function
1	FB	Output Voltage Selection and Feedback Input. Connect this pin to G for V_{OUT} = 5V, to OUT for V_{OUT} = 3.3V. Connect FB to a resistor divider to set the output voltage using the following equation, $V_{OUT}= 0.6V(1+R1/R2)$
2	G	Ground. Tie this pin directly to the local ground plane.
3	EN	Enable Pin. Tie this pin to 0.6V or higher to enable the device. Tie below 0.3V to turn off the device.
4	SW	Switch Pin. Connect an inductor between this pin and Vin. Minimize the metal trace area connected to this pin to minimize EMI.
5	OUT	Output Pin. OUT also provides power to the IC itself.

ABSOLUTE MAXIMUM RATINGS

SW Voltage	-0.3V ~ 5.5V
EN, FB, OUT Voltage	-0.3V ~ 5.5V
Junction to Ambient Thermal Resistance	190℃/W
Maximum Power Dissipation	0.45W
Operating Temperature Range	-40℃ ~ 85℃
Storage Temperature	-55℃ ~ 150℃

Stresses above may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

V_{IN}=1.8V, V_{OUT}=3.3V, unless otherwise specified. Typical values are at T_A=25℃

| Parameter	Conditions	MIN	TYP	MAX	Unit
Minimum Input Voltage		-	0.7	-	V
Startup Voltage		-	0.85	1.1	V
Output Voltage	FB = OUT	3.23	3.3	3.36	V
	FB = G	4.90	5	5.10	V
FB Feedback Voltage	V_{OUT} = 2.5 to 5V	-	0.6	-	V
FB Input Current		-	-	50	nA
Output Voltage Range	External divider	2.5	-	5	V
Quiescent Current at OUT	V_{FB} = 0.7V	-	50	-	µA
Shutdown Supply Current at OUT	EN = G	-	0.1	1	µA
Switching Frequency		-	1.0	-	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} = 5.5V, V_{SW} = 0 or 5.5V, EN = G	-	-	1	uA
EN Input Current		-	-	1	uA
EN Input Low Voltage		-	-	0.3	V
EN Input High Voltage		0.6	-	-	V

TYPICAL PERFORMANCE CHARACTERISTICS

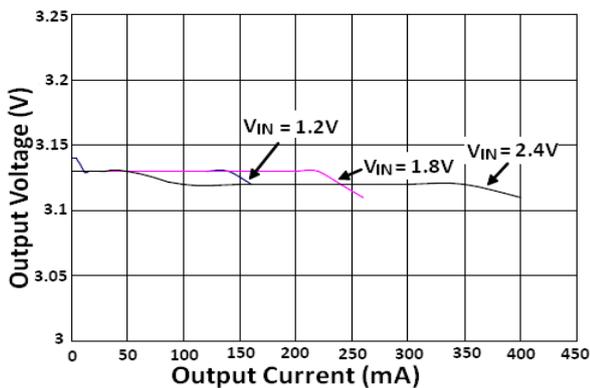Typical values are tested at T_A = 25℃, unless otherwise specified.

1. Efficiency vs. Output Current
    V_{OUT} = 3.3V, T_A = 25℃
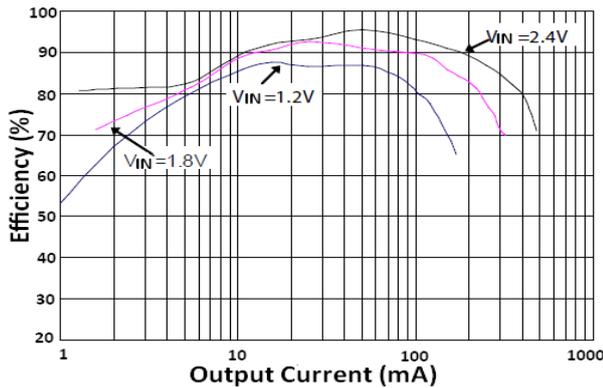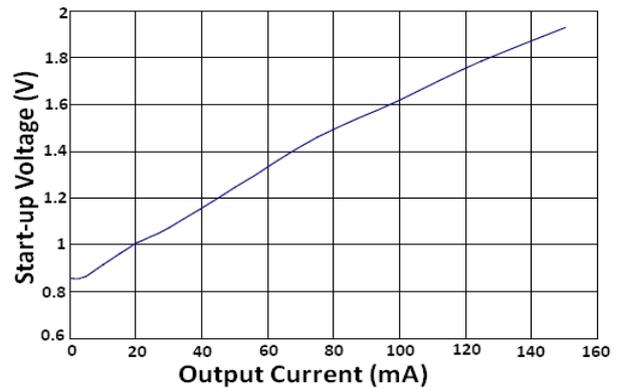

2. Efficiency vs. Output Current
    V_{OUT} = 5V, T_A = 25℃
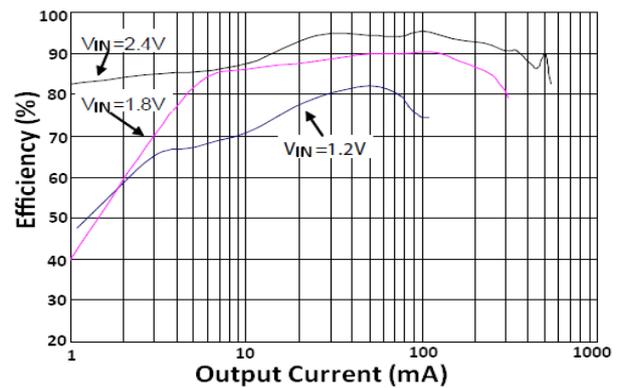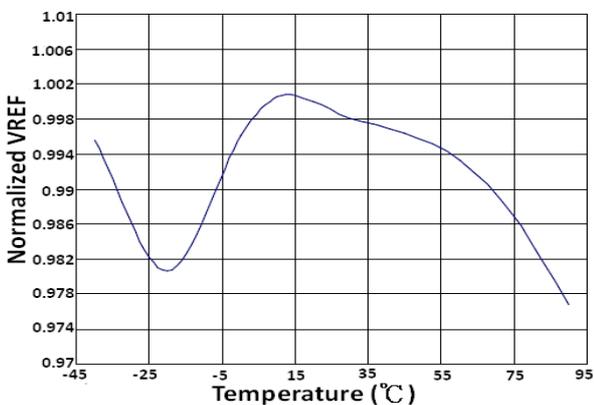

3. Output Voltage vs. Output Current
    V_{OUT} = 3.3V, T_A = 25℃

4. Minimum Start-Up Voltage vs. Output Current
    V_{OUT} = 3.3V, T_A = 25℃
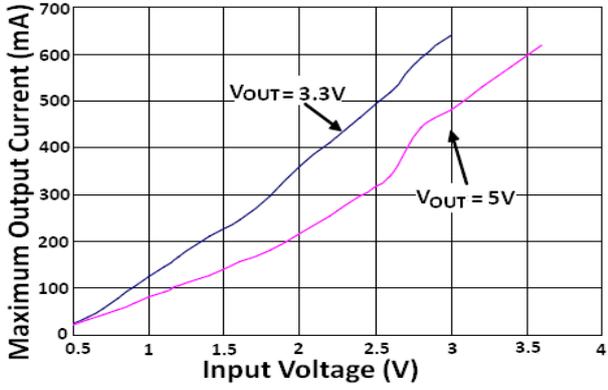

5. $V_{REF}(T)$ / $V_{REF}(T = 20℃)$ vs. Temperature

6. No Load Input Current vs. Input Voltage
    V_{OUT} = 3.3V, T_A = 25℃, No load
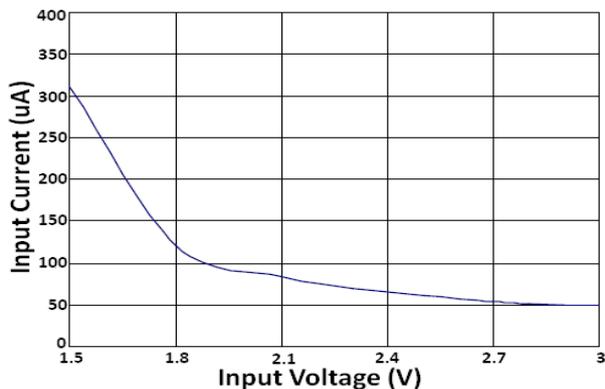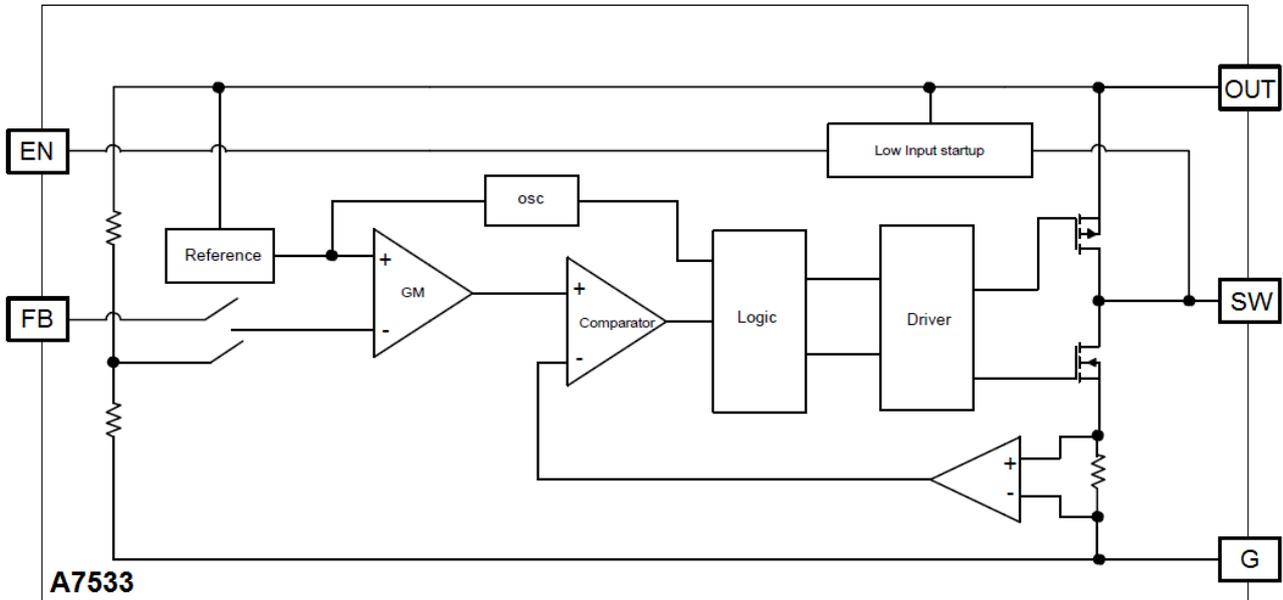
7. Maximum Output Current vs. Input Voltage
    L = 4.7uH, T_A = 25℃

BLOCK DIAGRAM

DETAIL INFORMATION

A7533 is a low input voltage start up, current mode DC-DC step up converter. It's 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 by storing energy in the inductor during on-time and releasing it to the output during off-time. When OUT 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 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.

Application Information

Output Voltage selection

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

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

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 A7533'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, 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 INFORMATION

Dimension in SOT-25 Package (Unit: mm)
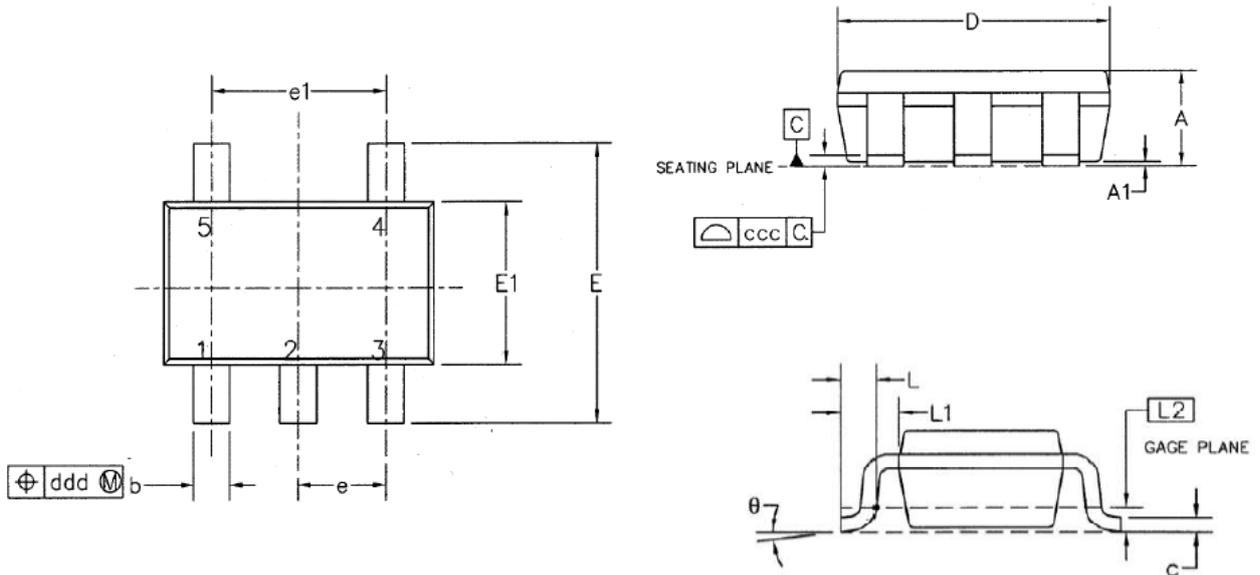
NOTE : Package Outline Exclusive Of Mold Flash and Metal Burr.

Symbol	Min	Max
A	0.90	1.10
A1	0.01	0.10
b	0.30	0.50
c	0.09	0.20
D	2.90 BSC	
E	2.60	3.00
E1	1.60 BSC	
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.55
L1	0.60 REF	
L2	0.25 BSC	
θ	0°	8°
ccc	0.10	0.10
ddd	0.20	0.20

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