2A，Synchronous Step Down Converter

GENERAL DESCRIPTION

The PW2052B is a 1.5MHz constant frequency, current mode step-down converter. It is ideal for portable equipment requiring very high current up to 2A from single-cell Lithium-ion batteries while still achieving over 90% efficiency during peak load conditions. The PW2052B also can run at 100% duty cycle for low dropout operation, extending battery life in portable systems while light load operation provides very low output ripple for noise sensitive applications. The PW2052B can supply up to 2A output load current from a 2.3V to 6V input voltage and the output voltage can be regulated as low as 0.6V. The high switching frequency minimizes the size of external components while keeping switching losses low. The internal slope compensation setting allows the device to operate with smaller inductor values to optimize size and provide efficient operation. The PW2052B is offered in a low profile (1mm) 6-pin, thin SOT package, and is available in an adjustable version.
This device offers two operation modes, PWM control and PFM Mode switching control, which allows a high efficiency over the wider range of the load

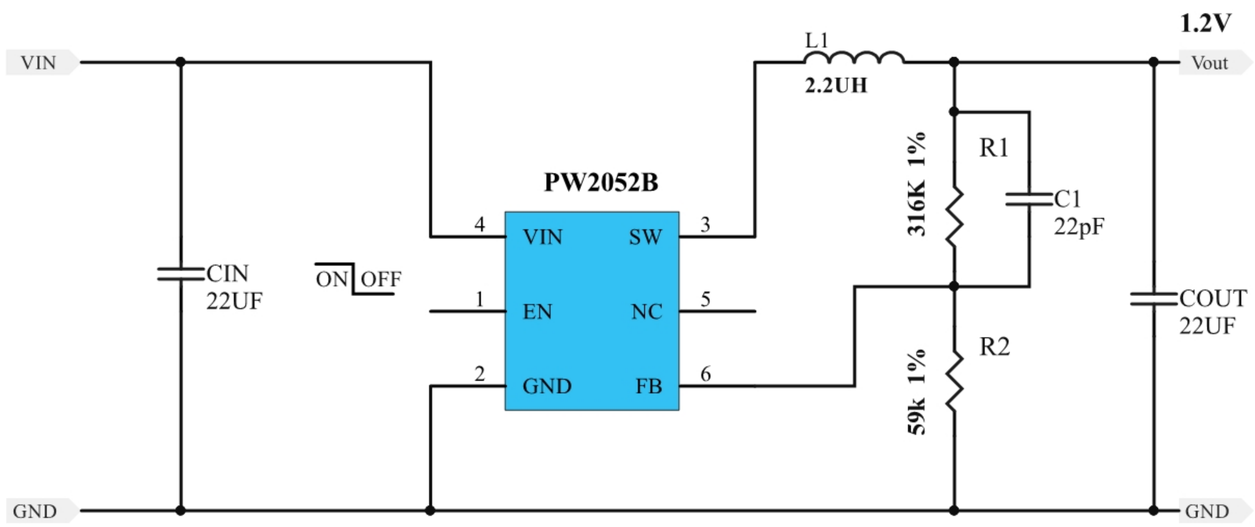
FEATURES

- High Efficiency: Up to 96%
- 1.5MHz Constant Frequency Operation
- 2A Output Current
- No Schottky Diode Required
- 2.3V to 6V Input Voltage Range
- Output Voltage as Low as 0.6V
- PFM Mode for High Efficiency in Light Load
- 100% Duty Cycle in Dropout Operation
- Low Quiescent Current: 40μA
- Short Circuit Protection
- Thermal Fault Protection
- Inrush Current Limit and Soft Start
- <1μA Shutdown Current
- SOT23-6 package

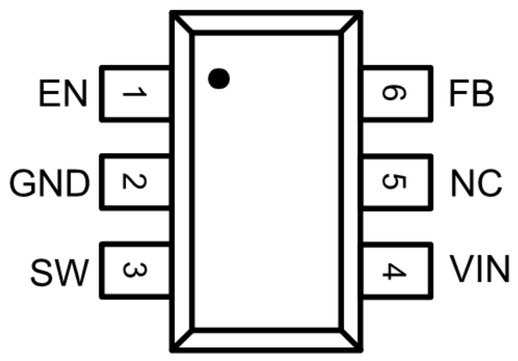
APPLICATIONS

- Cellular and Smart Phones
- Wireless and DSL Modems
- PDAs
- Portable Instruments
- Digital Still and Video Cameras

TYPICAL APPLICATION CIRCUIT

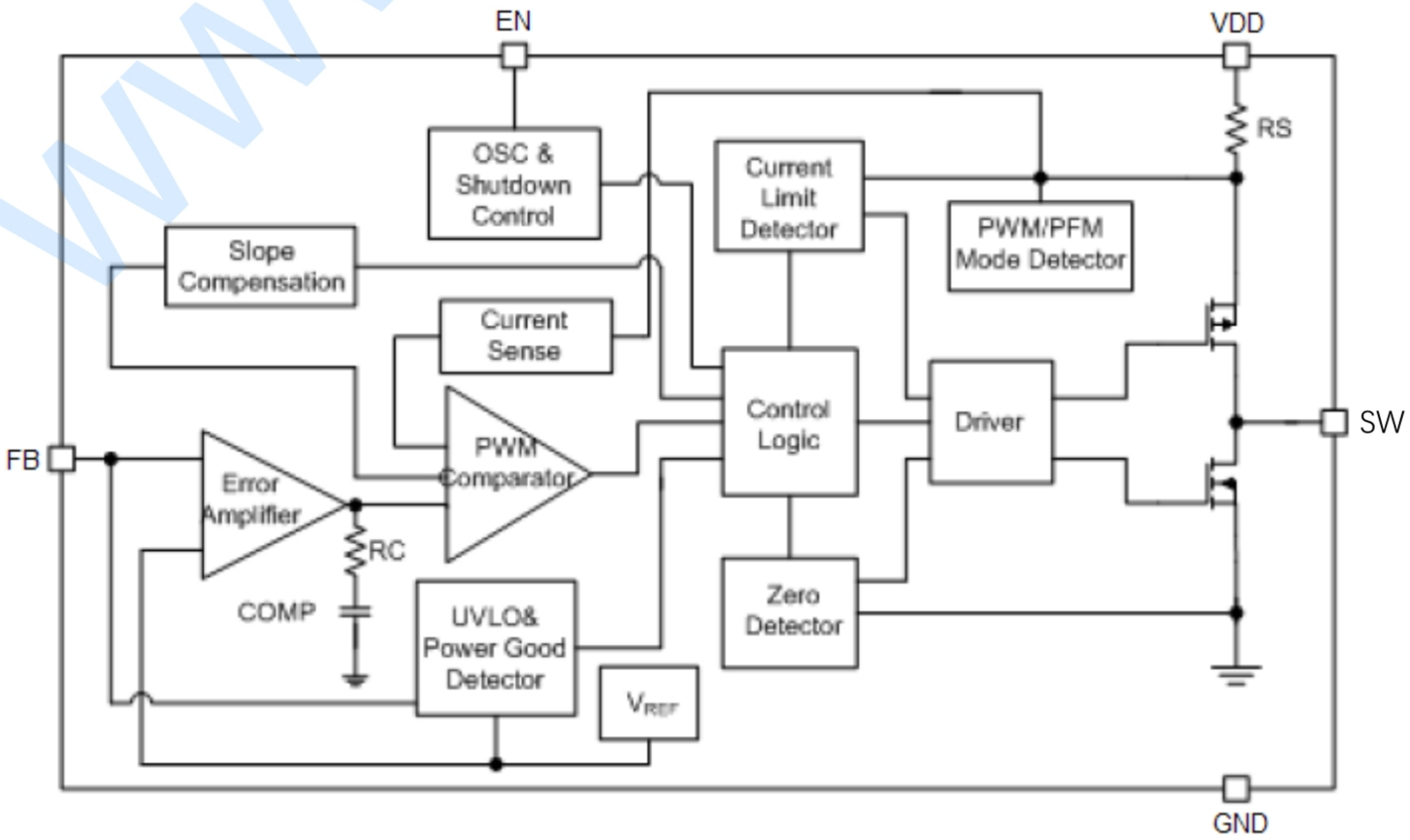


PIN ASSIGNMENT/DESCRIPTION



Pin Number	Pin Name	Function
1	EN	Chip Enable Pin. Drive EN above 1.5V to turn on the part. Drive EN below 0.3V to turn it off. Do not leave EN floating.
2	GND	IC Ground
3	SW	Power Switch Output. It is the switch node connection to Inductor. This pin connects to the drains of the internal P-ch and N-ch MOSFET switches.
4	VIN	Analog supply input pin.
5	NC	No Connect.
6	FB	Output Voltage Feedback Pin. An internal resistive divider divides the output voltage down for comparison to the internal reference voltage.

Function Block Diagram



Absolute Maximum Ratings (note1)

Item	VALUE	Unit
Input Supply Voltage	-0.3 to 6.5	V
EN,FB Voltages	-0.3 to (VIN+0.3)	V
SW Voltages	-0.3 to (VIN+0.3)	V
Power Dissipation	0.6	W
Thermal Resistance θJC	130	°C /W
Thermal Resistance θJA	250	°C /W
Junction Temperature(Note2)	150	°C
Operating Temperature Range	-40 to 85	°C
Lead Temperature(Soldering,10s)	300	°C
Storage Temperature Range	-65 to 150	°C
ESD HBM(Human Body Mode)	2000	V
ESD MM(Machine Mode)	200	V

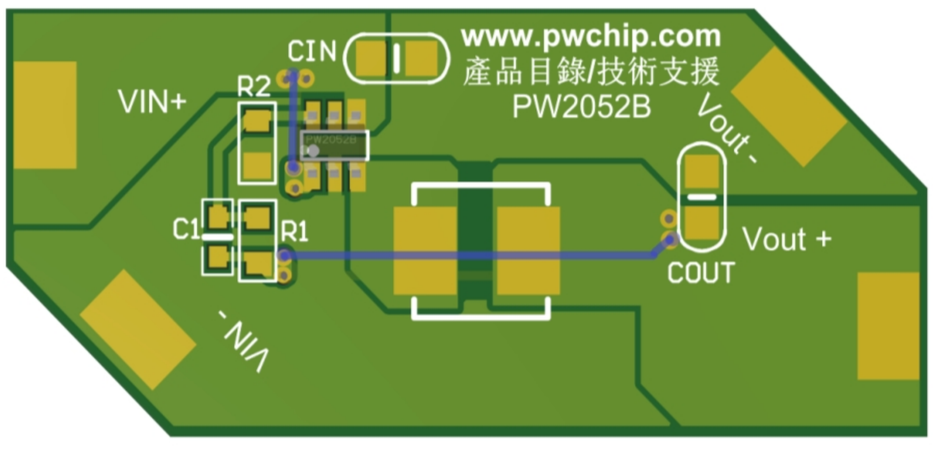
Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: TJ is calculated from the ambient temperature TA and power dissipation PD according to the following formula: TJ = TA + (PD) x (250°C/W).

PCB Layout Recommendations

When laying out the printed circuit board, the following checking should be used to ensure proper operation of the PW2052B. Check the following in your layout:

1. The power traces, consisting of the GND trace, the SW trace and the Vin trace should be kept short, direct and wide.
2. Does the (+) plates of CIN connect to VIN as closely as possible. This capacitor provides the AC current to the internal power MOSFETs.
3. Keep the switching node, SW, away from the sensitive VOUT node.
4. Keep the (-) plates of CIN and COUT as close as possible



Suggested Layout

ELECTRICAL CHARACTERISTICS(note1)

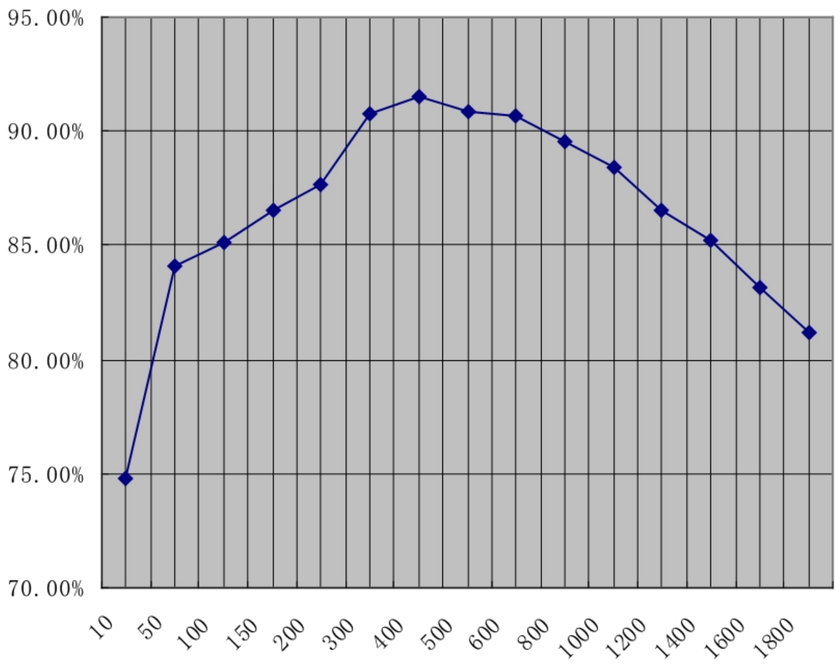
(VIN=VEN=3.6V, VOUT=1.8V, TA = 25°C, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range		2.3		6	V
UVLO Threshold		1.7	1.9	2.1	V
Input DC Supply Current	(Note 2)				μA
PWM Mode	V_{OUT} = 90%, I_{LOAD}=0mA		150	300	μA
PFM Mode	V_{OUT} = 105%, I_{LOAD} =0mA		40	75	μA
Shutdown Mode	V_{EN} = 0V, V_{IN}=4.2V		0.1	1.0	μA
Regulated Feedback Voltage V_{FB}	T_A = 25°C	0.588	0.600	0.612	V
Reference Voltage Line Regulation	V_{IN} =2.5V to 5.5V		0.1		%/V
Output VoltageAccuracy	V_{IN} =2.5V to 5.5V Iout=10mA to 2000mA	-3		+3	%
Output Voltage Load Regulation	Iout=10mA to 2000mA		0.2		%/A
Oscillation Frequency	V_{OUT} =100%		1.5		MHz
	V_{OUT} =0V		300		kHz
On Resistance of PMOS	I_{SW}=100mA		100	150	mΩ
On Resistance of NMOS	I_{SW}=-100mA		90	150	mΩ
Peak Current Limit	V_{IN}= 3V, V_{OUT} =90%		4		A
EN Threshold		0.3	1.0	1.5	V
EN Leakage Current			±0.01	±1.0	μA
SW Leakage Current	V_{EN}=0V,V_{IN}=V_{SW}=5V		±0.01	±1.0	μA

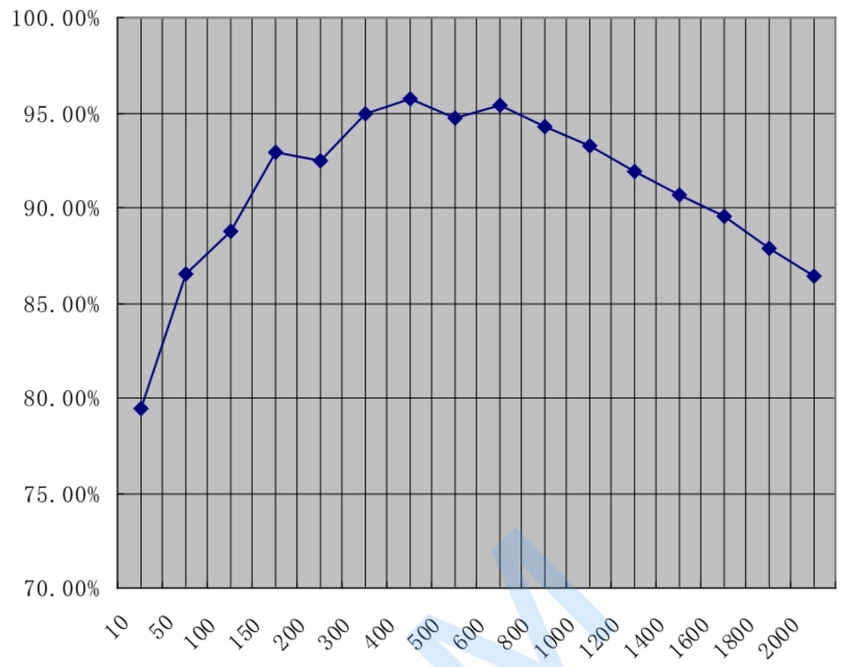
Note 1: 100% production test at +25°C. Specifications over the temperature range are guaranteed by design and characterization.

Note 2: Dynamic supply current is higher due to the gate charge being delivered at the switching frequency.

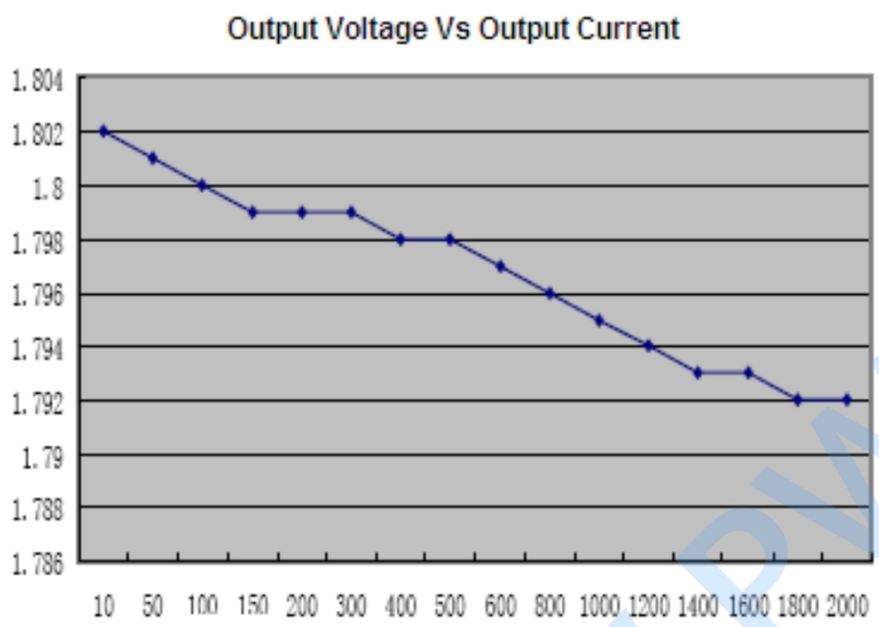
TYPICAL OPERATING CHARACTERISTICS



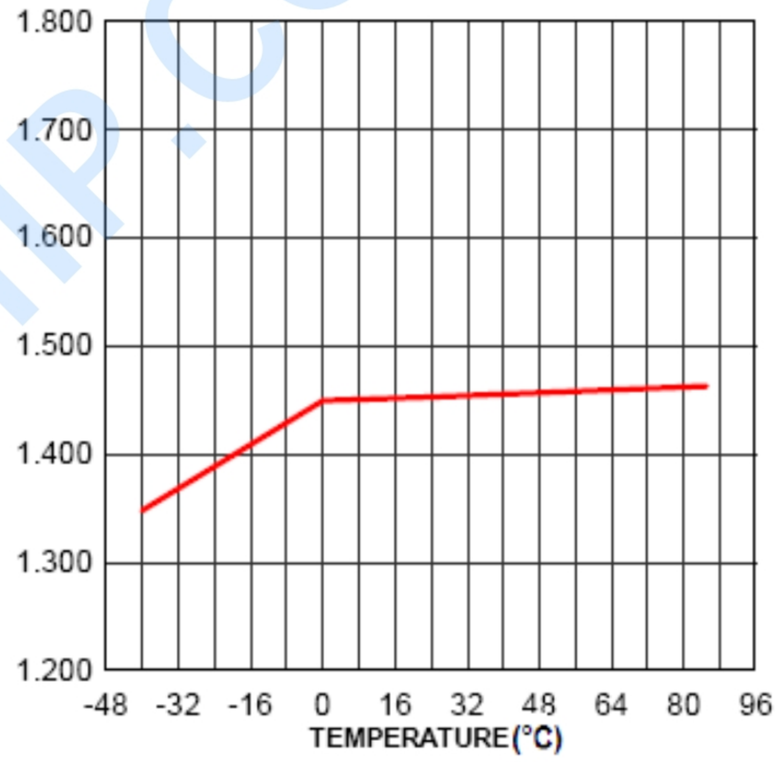
Vin=5V, Vout=1.8V



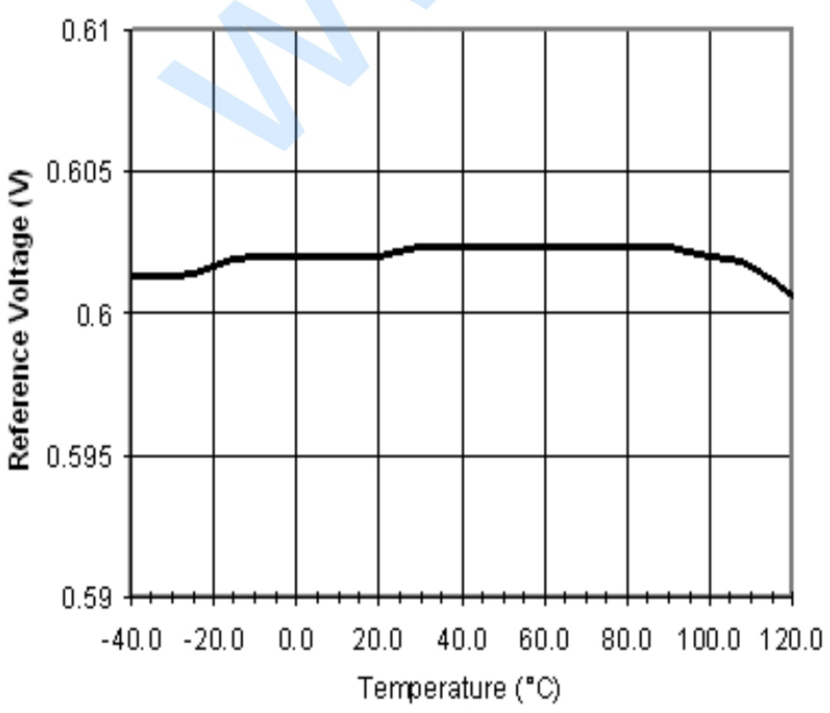
Vin=5V, Vout=3.3V



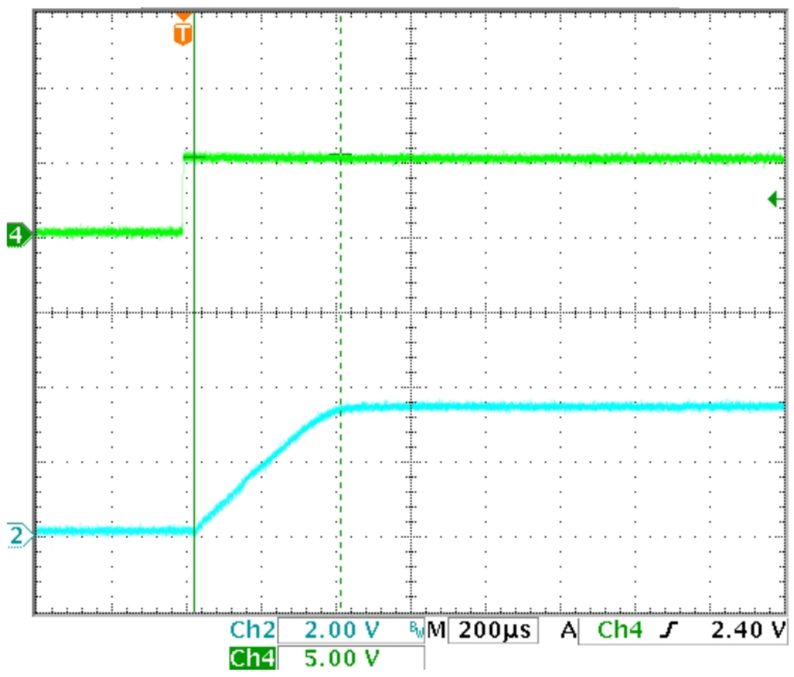
Vin=3.6V, Vout=1.8V



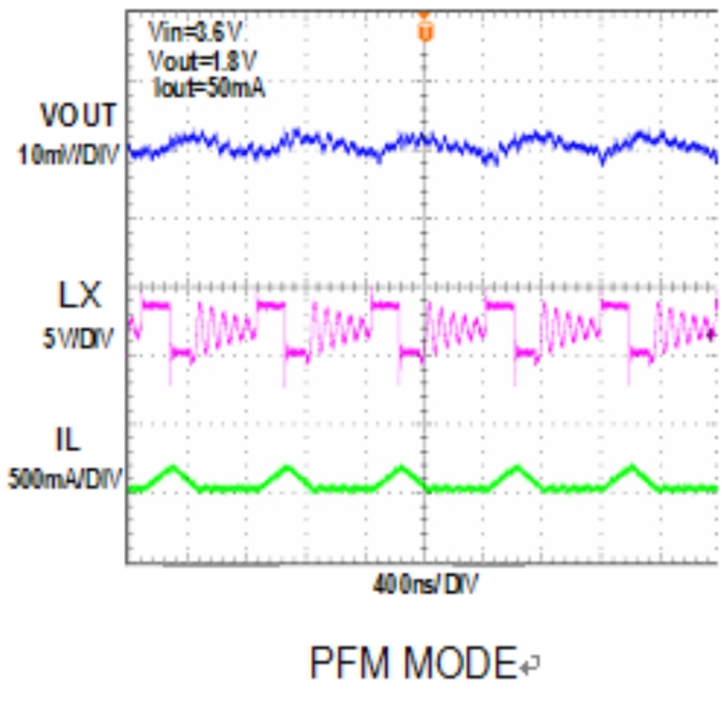
Oscillator Frequency VS Temperature



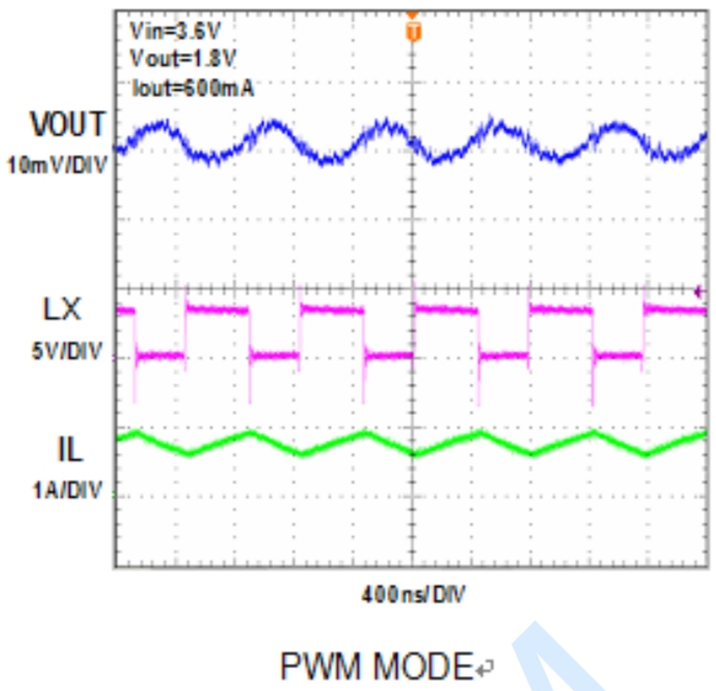
Vin=3.6V, Vout=1.8V



Start-Up



PFM MODE



PWM MODE

Function Description

The PW2052B is a high output current monolithic switch mode step-down DC-DC converter. The device operates at a fixed 1.5MHz switching frequency, and uses a slope compensated current mode architecture. This step-down DC-DC converter can supply up to 2A output current at VIN = 3.6V and has an input voltage range from 2.3V to 6V. It minimizes external component size and optimizes efficiency at the heavy load range. The slope compensation allows the device to remain stable over a wider range of inductor values so that smaller values (1μH to 4.7μH) with lower DCR can be used to achieve higher efficiency. Only a small bypass input capacitor is required at the output. The adjustable output voltage can be programmed with external feedback to any voltage, ranging from 0.6V to near the input voltage. It uses internal MOSFETs to achieve high efficiency and can generate very low output voltages by using an internal reference of 0.6V. At dropout operation, the converter duty cycle increases to100% and the output voltage tracks the input voltage minus the low RDS(ON) drop of the P-channel high-side MOSFET and the inductor DCR. The internal error amplifier and compensation provides excellent transient response, load and line regulation. Internal soft start eliminates any output voltage overshoot when the enable or the input voltage is applied.

Application Information

Setting the Output Voltage

The internal reference V_{REF} is 0.6V (Typical). The output voltage is divided by a resistor divider,R1 and R2 to the FB pin. The output voltage is given by

$$\left(1+\frac{R1}{R2}\right)*0.6V = Vout$$

Inductor Selection

For most designs, the PW2052B operates with inductors of 1μH to 4.7μH. Low inductance values are physically smaller but require faster switching, which results in some efficiency loss. The inductor value can be derived from the following equation:

$$L = \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times \Delta I_L \times f_{OSC}}$$

Where Δ IL is inductor Ripple Current. Large value inductors result in lower ripple current and small value inductors result in high ripple current. For optimum voltage-positioning load transients, choose an inductor with DC series resistance in the 50mΩ to 150mΩ range.

Capacitor Selection

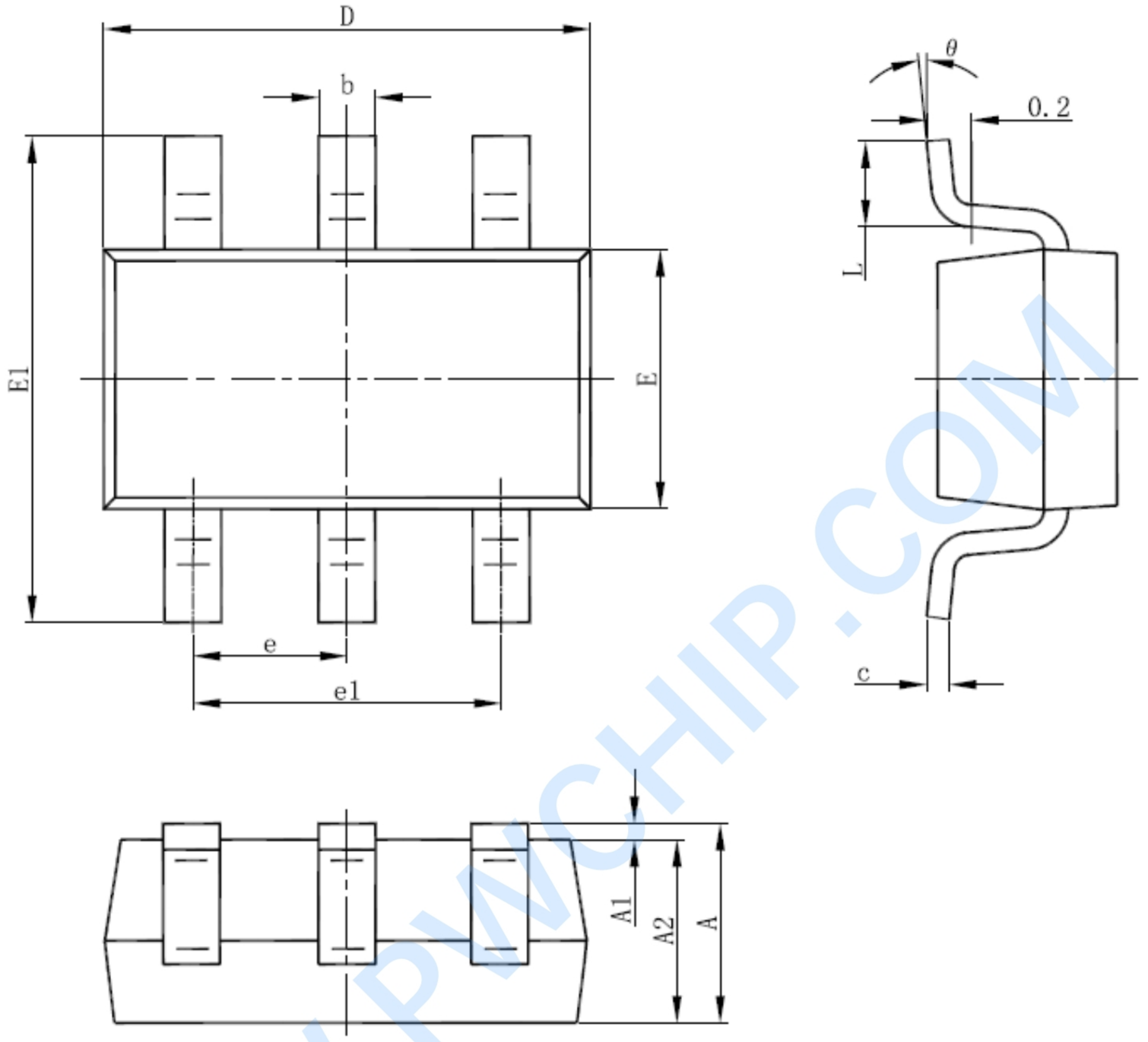
The input capacitor reduces the surge current drawn from the input and switching noise from the device. The input capacitor impedance at the switching frequency should be less than input source impedance to prevent high frequency switching current passing to the input. A low ESR input capacitor sized for maximum RMS current must be used. Ceramic capacitors with X5R or X7R dielectrics are highly recommended because of their low ESR and small temperature coefficients. A 22uf ceramic capacitor for most applications is sufficient. A large value may be used for improved input voltage filtering.

The output capacitor is required to keep the output voltage ripple small and to ensure regulation loop stability. The output capacitor must have low impedance at the switching frequency. Ceramic capacitors with X5R or X7R dielectrics are recommended due to their low ESR and high ripple current ratings. The output ripple Δ VOUT is determined by: （A 22μF ceramic can satisfy most applications.）

$$\Delta V_{OUT} \le \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times f_{OSC} \times L} \times \left(ESR + \frac{1}{8 \times f_{osc} \times C3} \right)$$

PACKAGE DESCRIPTION

SOT23-6L



Symbol	Dimensions In Millimeters	
	Min	Max
A	0.900	1.450
A1	0.000	0.150
A2	0.900	1.300
b	0.300	0.500
c	0.100	0.200
D	2.800	3.000
E	1.500	1.700
E1	2.650	2.950
e	0.950(BSC)	
e1	1.800	2.000
L	0.300	0.600
θ	0°	8°

NOTE：

Preliminary and all contents are subject to change without prior notice.