

200mA, 1.5MHz Micropower Synchronous Boost Converter

■ General Description

The XT1800 is a synchronous, fixed frequency, step-up DC/DC converters delivering high efficiency in a 6-lead SOT package. The devices contain an internal NMOS switch and PMOS synchronous rectifier.

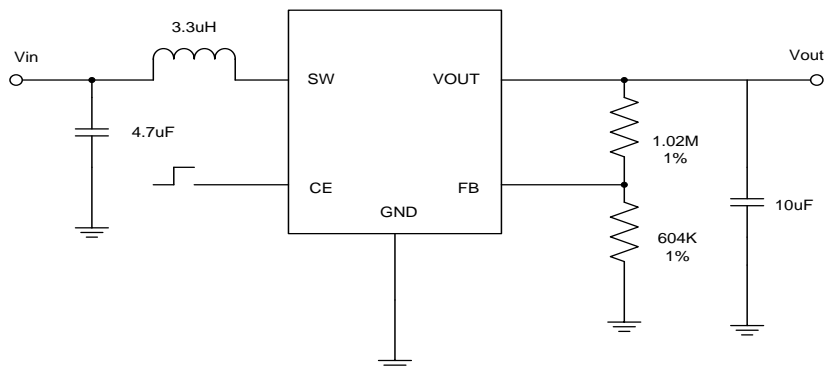
A switching frequency of 1.5MHz minimizes solution footprint by allowing the use of tiny, low profile inductors and ceramic capacitors. The current mode PWM design is internally compensated, reducing external parts count. The XT1800 features automatic shifting to power saving PFM Mode operation at light loads. Antiringing control circuitry reduces EMI concerns by damping the inductor in discontinuous mode, and the devices feature low shutdown current of under 1 μ A.

Both devices are available in the low profile SOT-23-6 package.

■ Applications

- MP3/4 PMP
- Digital Camera
- LCD Bias Voltage
- Handheld Instruments
- Wireless Handsets
- GPS Receivers

■ Typical Application Circuit



■ Features

- Up to 93% efficiency
- 1.5MHz fixed frequency switching
- Internal synchronous rectifier
- 2.5V to 5V output range
- Automatic PFM/PWM mode operation
- Logic controlled shutdown (<1 μ A)
- Antiringing control minimizes EMI
- Tiny external components
- Low profile SOT-23-6 package

■ Package

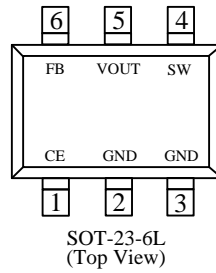
- SOT-23-6

■ Ordering Information

XT1800 ①②③④

Designator	Symbol	Description
①	25-50/AD	Output Voltage: e.g. 33= 3.3V etc.
②		Adjustable version: ①② fixed as AD Accuracy: ±2%
③	M	Package Types: SOT-23-6
④	S	Embossed Tape :Standard Feed
	R	Embossed Tape :Reverse Feed

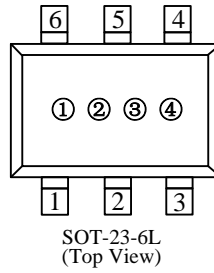
■ Pin Assignment



■ Functional Pin Description

Pin Number	Name	Function
SOT-23-6		
1	CE	Chip Enable pin. Active high. Internal pull high for auto start up.
2、3	GND	Ground Pin.
4	SW	Switch Pin.
5	VOUT	Output Pin.
6	FB	Feedback Pin.

■ Marking Rule



① Represents the product name

Symbol	Product Name
8	XT1800◆◆◆◆

② Represents the output voltage type

Symbol	Represents
A	Output voltage is adjustable
F	Output voltage is fixed

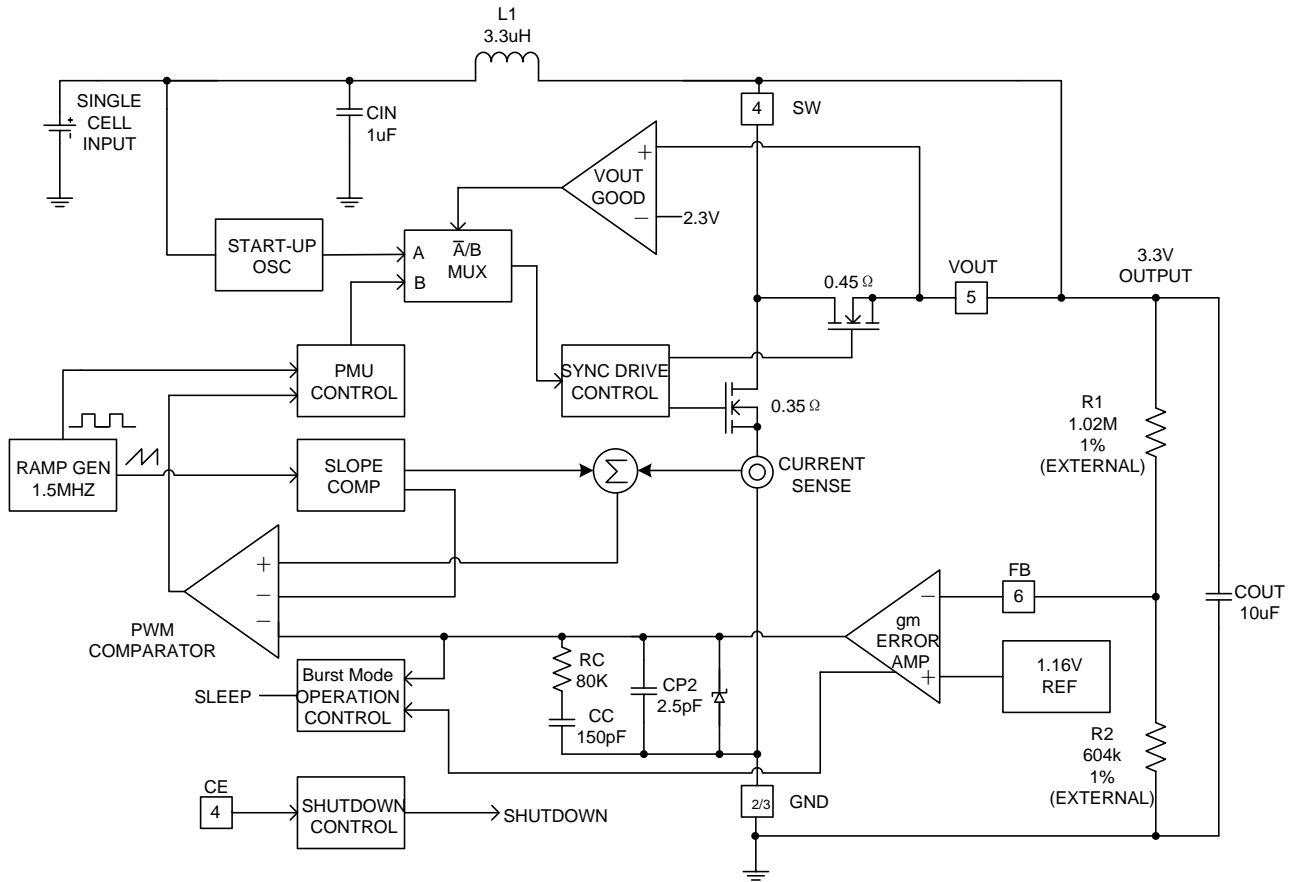
③ Represents the package type

Symbol	Represents
M	SOT-23-6

④ Represents the assembly lot No.

0-9, A-Z; 0-9, A-Z mirror writing, repeated (G, I, J, O, Q, W exception)

■ Function Block Diagram



■ Absolute Maximum Ratings

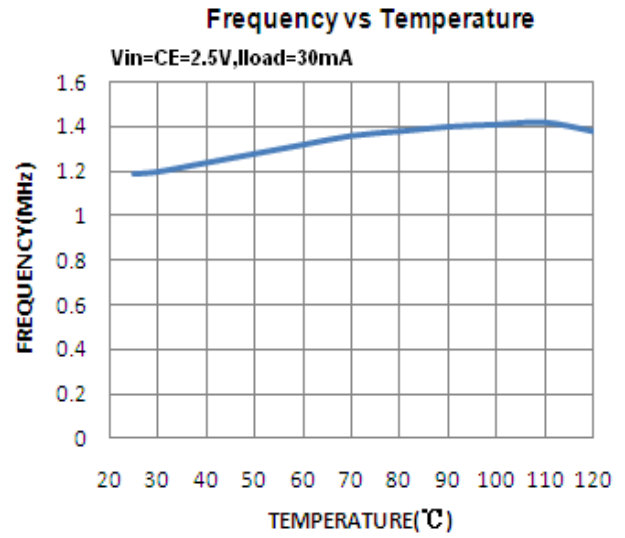
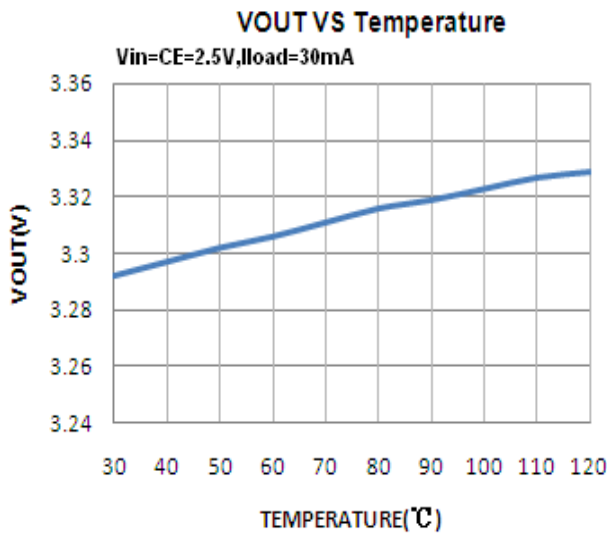
Parameter	Symbol	Maximum Rating	Unit
Input Voltage	V_{IN}	$V_{SS}-0.3 \sim V_{SS}+6$	V
	V_{sw}	$V_{SS}-0.3 \sim V_{IN}+0.6$	
	$V_{CE,FB,VOUT}$	$V_{SS}-0.3 \sim V_{IN}+0.3$	
Power Dissipation	P_D	SOT-23-6 600	mW
Operating Ambient Temperature	T_{opr}	-40~+85	°C
Storage Temperature	T_{stg}	-40~+125	
Reflow Temperature(soldeing,10s)	T_{refl}	250	°C

Electrical Characteristics

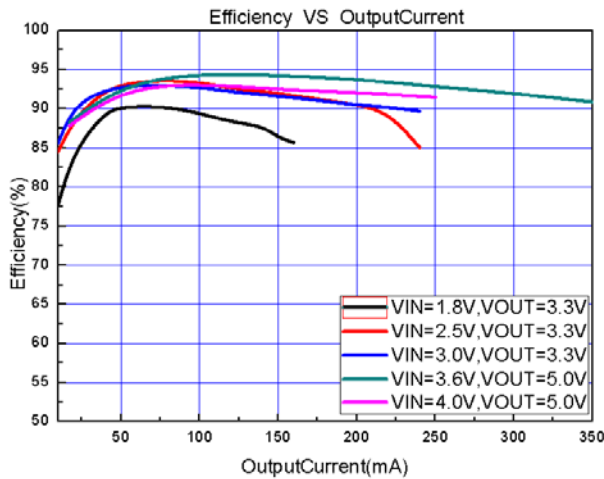
(Vin=2.5V, Vout=3.3V, TA=25°C, unless otherwise specified)

Parameter	Conditions	Min	Typ	Max	Units
Minimum Start-Up Voltage	I _{LOAD} = 1mA	1.8	2.0		V
Output Voltage Adjust Range		2.5		5	V
Feedback Voltage		1.14	1.16	1.18	V
Feedback Input Current	V _{FB} = 1.16V		1		nA
Quiescent Current (Shutdown)	V _{SHDN} = 0V, Not including switch leakage		0.01	1	μA
Quiescent Current (Active)	Measured On VOUT		300	500	μA
NMOS Switch Leakage	V _{SW} = 5V		0.1	5	μA
PMOS Switch Leakage	V _{SW} = 0V		0.1	5	μA
NMOS Switch On Resistance	V _{OUT} = 3.3V		0.4		Ω
	V _{OUT} = 5.0V		0.3		Ω
PMOS Switch On Resistance	V _{OUT} = 3.3V		0.5		Ω
	V _{OUT} = 5.0V		0.4		Ω
NMOS Current Limit		0.7	1		A
Max Duty Cycle		75	-	87	%
Switching Frequency		1.3	1.5	1.7	MHz
CE input high		1			V
CE input low				0.3	V
CE input current	V _{CE} = 5.5V		0.1	1	μA

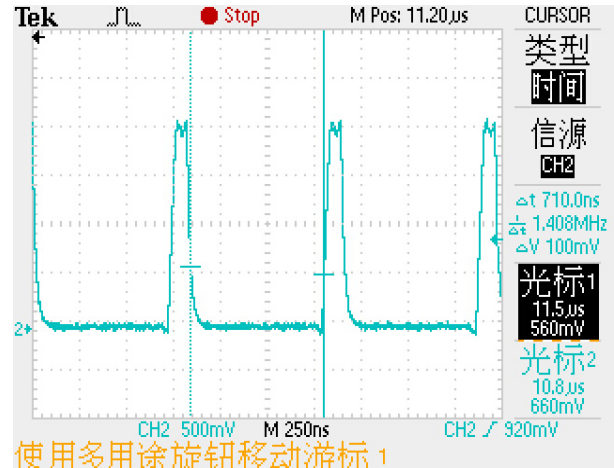
Typical Performance Characteristics



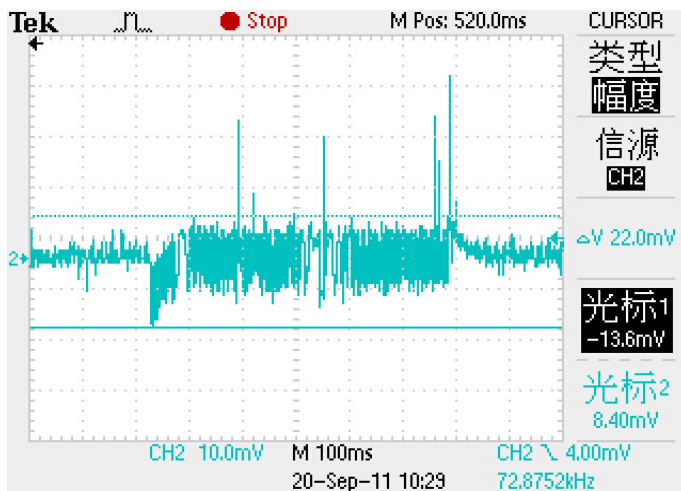
Efficiency



Maximum duty



Load transient response



■ Operation

The XT1800 are 1.5MHz, synchronous boost converters housed in a 6-lead SOT package. The devices feature fixed frequency, current mode PWM control for exceptional line and load regulation. With its low $R_{DS(ON)}$ and gate charge internal MOSFET switches, the devices maintain high efficiency over a wide range of load current. Detailed descriptions of the three distinct operating modes follow. Operation can be best understood by referring to the block diagram.

- **Device Enable**

The device starts to work when CE is higher than 1.0V. And it shuts down when CE is lower than 0.6V. In shutdown mode, the regulator stops switching, all internal control circuit is off, and the load is disconnected from the input.

- **Error Amp**

The error amplifier is an internally compensated transconductance type amplifier. The internal 1.16V reference voltage is compared with the voltage at the FB pin to generate an error signal at the output of the error amplifier.

- **Current Sensing**

A signal representing NMOS switch current is summed with the slope compensator. The summed signal is compared to the error amplifier output to provide a peak current control command for the PWM. Peak switch current is limited to approximately 2.5 A independent of input or output voltage. The current signal is blanked for 40ns to enhance noise rejection.

- **Zero Current Comparator**

The zero current comparator monitors the inductor current to the output and shuts off the synchronous rectifier once this current reduces to approximately 20mA. This prevents the inductor current from reversing in polarity improving efficiency at light loads.

- **Antiringing Control**

The antiringing control circuitry prevents high frequency ringing of the SW pin as the inductor current goes to zero by damping the resonant circuit formed by L and CSW (capacitance on SW pin).

■ Application Information

● Setting the Output Voltage

The external voltage divider from Vout to GND programs the output voltage via FB from 2.5V to 5V according to the formula:

$$V_{out} = 1.16V \times \left(1 + \frac{R1}{R2}\right)$$

● Setting the Inductor

The inductor with 3.0A current rating and low DC resistance is recommended. The inductance value can be calculated from the following formula:

$$L = \frac{V_{in} \times (V_{out} - V_{in})}{V_{out} \times \Delta I_L \times f_s}$$

Where ΔI_L is the inductor current ripple. It is recommended the inductor current ripple to be around 30%~50% of the input current.

● Setting the Input Capacitor

The input capacitor (C1) is required to maintain the DC input voltage. Ceramic capacitors with low ESR/ESL types are recommended. The input voltage ripple can be estimated by:

$$\Delta V_{in} = \frac{V_{in}}{8 \times f_s^2 \times L \times C1} \times \left(1 - \frac{V_{in}}{V_{out}}\right)$$

Typically, a 4.7 μ F X7R ceramic capacitor is recommended.

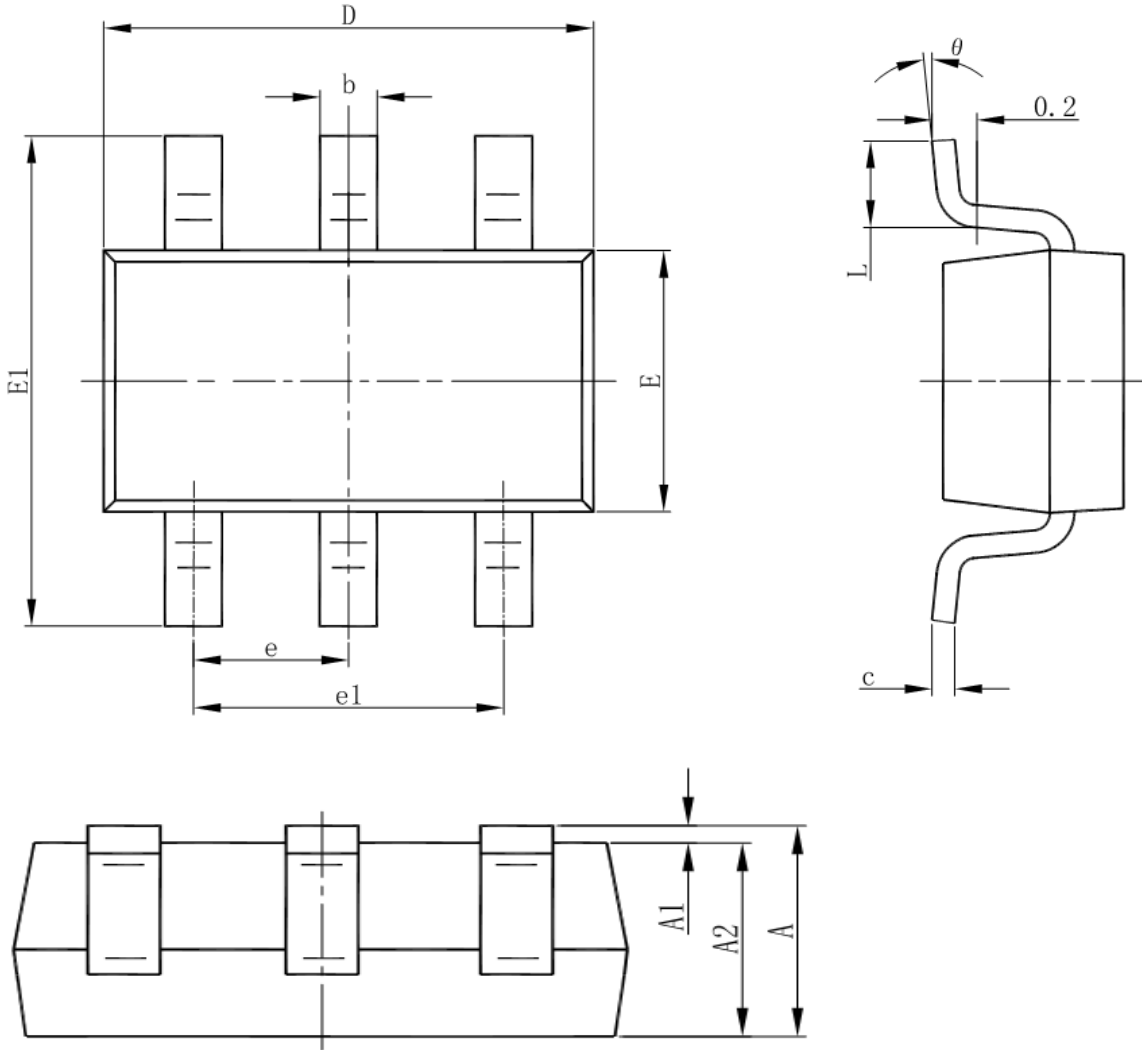
● Setting the Output Capacitor

The output current to the step-up converter is discontinuous, therefore a capacitor is essential to supply the AC current to the load. Use low ESR capacitors for the best performance. Ceramic capacitors with X7R dielectrics are highly recommended because of their low ESR and small temperature coefficient. The output voltage ripple can be estimated by:

$$\Delta V_{out} = \frac{V_{out}}{C2 \times f_s \times R_L} \times \left(1 - \frac{V_{in}}{V_{out}}\right) \quad \text{Typically, a } 10\mu\text{F X7R ceramic capacitor is recommended.}$$

■ Package Information

- SOT-23-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°