DC-DC Boost Converter with a 4.5A Switch

■ General Description

The XT1863 is a current mode step-up converter with a 4.5A, 0.08Ω internal switch to provide a highly efficient regulator with fast response. The XT1863 operates at 1.5MHz allowing for easy filtering and low noise. The XT1863 includes under-voltage lockout, current limiting and thermal overload protection to prevent damage in the event of an output overload.

■ Applications

- Battery-Powered Equipment
- Portable Applications
- Back-up Power Supply

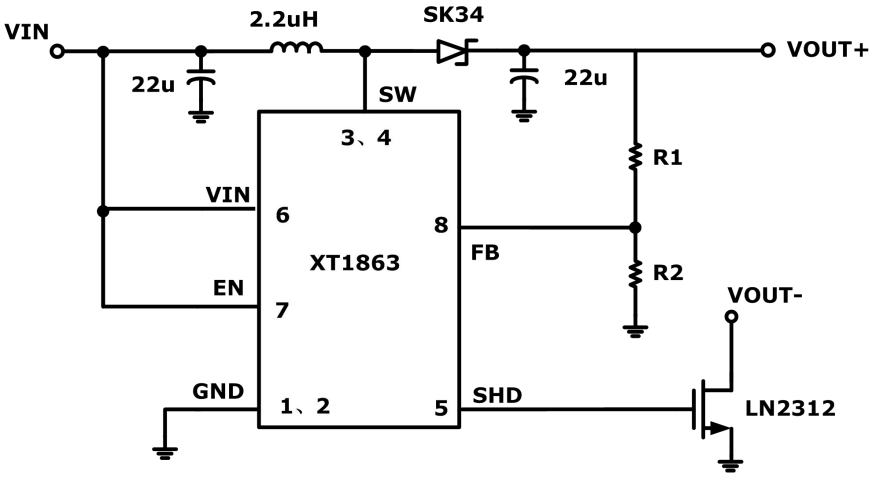
■ Features

- Operating frequency: 1.5MHz
- Low Quiescent Current: 80μA
- PWM/PFM Mode
- 5V at 2A from Battery Li-ion
- True Shutdown from Load Path

■ Package

- DFNWB3*3-8L

■ Typical Application Circuit



$VOUT+ = 0.6 \times \left(1 + \frac{R1}{R2}\right)$, VOUT- is the negative terminal of load path. This function is designed to shutdown the load path at any abnormal condition. If SHD is not used, please do not connect this pin.

■ Ordering Information

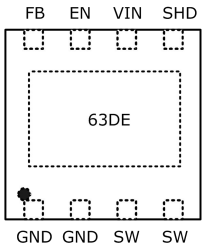
XT1863P ①②③

数字项目	符号	描述
①	S	True Shutdown from Load Path
②	D	Package Types: DFNWB3*3-8L
③	R	Embossed Tape : Standard Feed
	S	Embossed Tape :Reverse Feed

■ Pin Assignment

Pin Number	Name	Function
1/2	GND	Ground
3/4	SW	Switch Pin.
5	SHD	Shutdown the Load Path, by using the external NMOSFET.
6	VIN	Input Pin.
7	EN	Chip Enable pin. High to turn on the part. Do not leave it floated.
8	FB	Feedback Pin.

■ Marking Rule

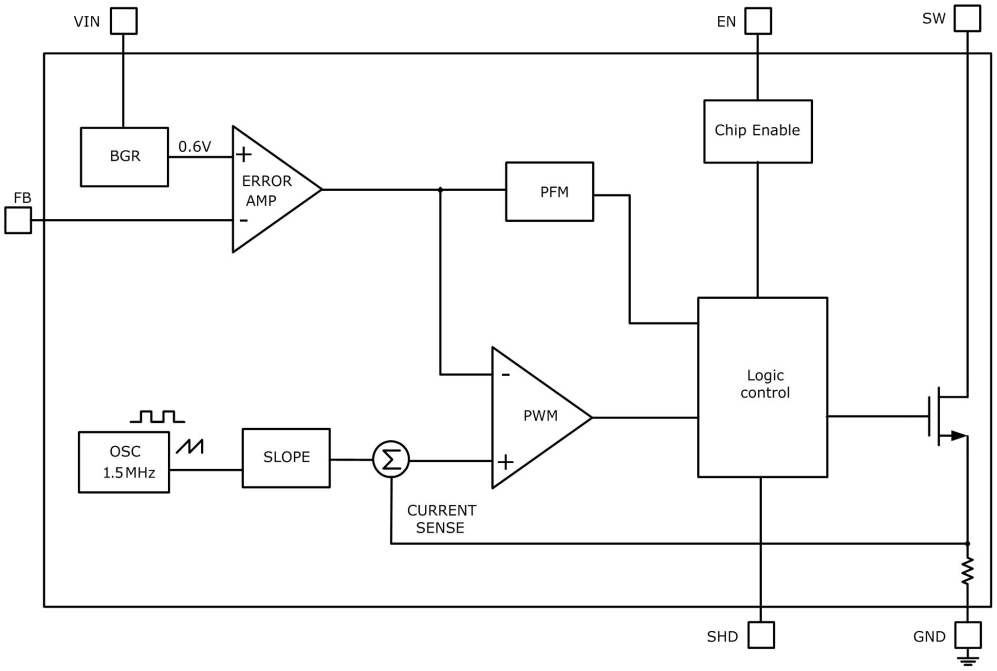


Note: Codes represent the assembly lot No.

■ Absolute Maximum Ratings

Parameter	Symbol	Maximum Rating	Unit
Input Voltage	VIN	Vss-0.3～Vss+6	V
Output Voltage	VOUT	Vss-0.3～Vss+6	
	VSW	Vss-0.3～Vss+6	
Current Limit	ISW	4.5	A
Power Dissipation	PD	500	mW
Operating Ambient Temperature	Topr	-40～＋80	℃
Storage Temperature	Tstg	-40～＋125	

■ Function Block Diagram



■ Electrical Characteristics

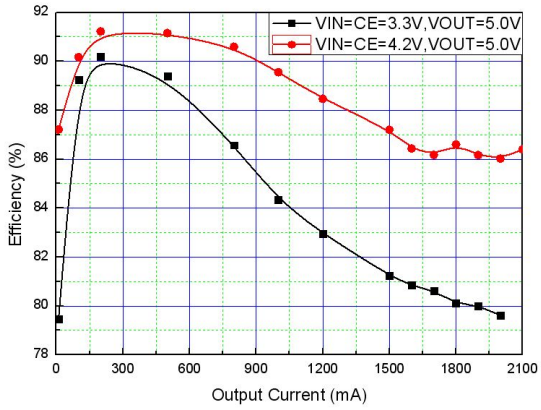
（VIN=3.6V，VOUT=5V，Ta=25℃，unless otherwise specified）

Parameter	Conditions	Min	Typ	Max	Units
Input Voltage	IOUT=2A	3	-	5	V
Output Voltage	-	3		5.5	
Shutdown Current	VEN<VENL	-	0.01	1	μA
Input Voltage without load	VIN=3.6V，VOUT=5V	-	80	-	μA
Feedback Voltage	VOUT=5V	588	600	612	mV
Output Voltage Line Regulation	IOUT=1A，VIN=3V to 4.5V	-	0.3	-	%
Output Voltage Load Regulation	VIN=3.6V，IOUT=10mA to 2A	-	0.4	-	%
Operating Frequency	IOUT=2A	1.3	1.5	1.7	MHz
Max Duty Cycle	VIN=3.6V	70	-	-	%
RDSON of NMOSFET	VIN=3.6V，ISW=2A	-	80	120	mΩ
NMOS Current Limit	VIN=3.6V	4.5	-	5	A
SW Leakage	VEN=0V, VSW=5V	-	±0.01	±1	uA
EN “High” Voltage	VIN=3.6V	0.9	-	-	V
EN “Low” Voltage	VIN=3.6V	-	-	0.8	V
Short-circuit Current	VIN=3.6V	-	100	-	uA
Over Temperature Shutdown	VIN=3.6V，IOUT=100mA	-	146	-	℃
Over Temperature Shutdown	-	-	20	-	℃

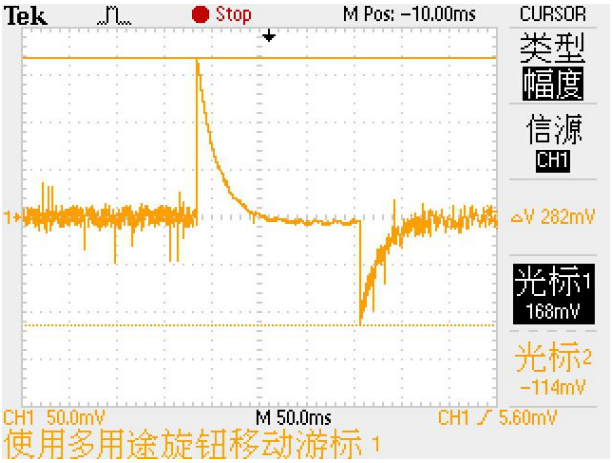
Hysteresis					

■ Typical Performance Characteristics

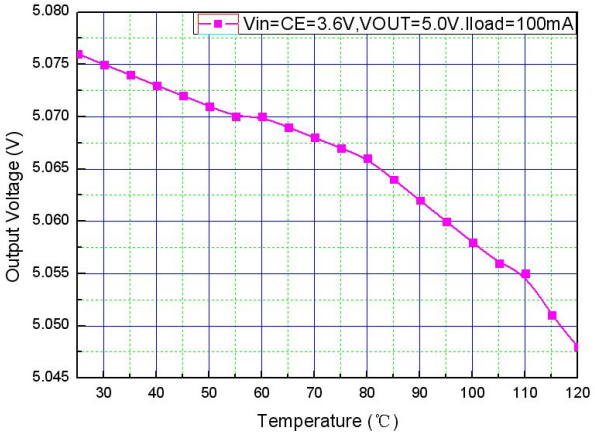
Efficiency VS Output Current



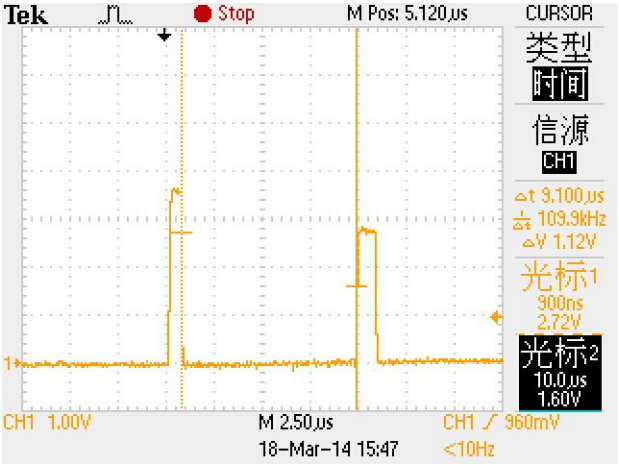
Load Transient Response: VIN=3.6V，1.5A→0→1.5A



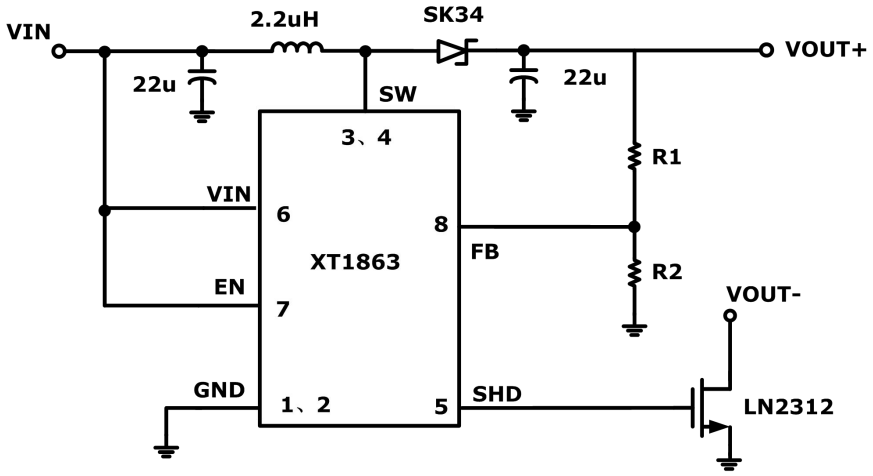
Output Voltage VS Temperature



Output Short Wave: VIN=3.6V, VOUT-=VOUT+



■ Typical Application



■ Application Information

The XT1863 is a switching mode Step-up DC-DC converter. It operates at a fixed switching frequency, and uses the slope compensated current mode architecture. XT1863 supplies 2A output current at VOUT=5V with 3V input voltage.

➢ **Setting the Output Voltage**

The output voltage VOUT can be set by using external divider resistors. The internal reference is 0.6V; the VOUT can be calculated by using the following equation:

$$VOUT = (1 + \frac{R1}{R2}) \times 0.6V$$

Connect divider resistors R1 and R2 as close to the IC as possible to minimize the effects of noise.

➢ **True Shutdown of Load Path**

The SHD PIN is used with the external NMOSFET to shutdown the load path at any abnormal condition. VOUT- is the negative terminal of load path. If SHD is not used, please do not connect this pin.

The external NMOSFET needs very low RDSON to guarantee the high efficiency. LN2312 is appropriate for its low RDSON 27mohm at VGS=3.6V.

LN2312 is the

➢ **PFM Mode**

At light loads, the XT1863 automatically enters PFM Mode. In the PFM Mode, The PWM control loop will automatically skip pulses according to the amount of the load current. Therefore, the oscillation circuit intermittently oscillates, reducing the self-current consumption. This prevents decrease in efficiency when the output load current is small. The ripple voltage during the PFM control is very small, so that the XT1863 realizes high efficiency and the low-noise power supply.

➢ **Inductor Selection**

For most designs, the XT1863 operates with inductors of 2.2μH. 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:

$$L = \frac{VOUT \times (VIN - VOUT)}{VIN \times \Delta IL \times \mathrm{fs}}$$

Where fs is the operation frequency, ΔIL is inductor Ripple Current. Large value inductors lower ripple current and small value inductors result in high ripple currents. Choose inductor ripple current approximately 40% of the maximum load current for optimum voltage-positioning load transients.

➢ **Input 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 shall be less than input source impedance to prevent high frequency switching current

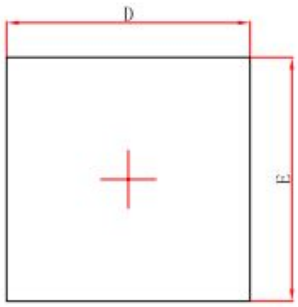
passing to the input. A low ESR input capacitor sized for maximum RMS current must be used. Ceramic capacitors with X5R or X7R dielectrics are highly recommended because of their low ESR and small temperature coefficients. A 22μF ceramic capacitor for most applications is sufficient.

➢ **Output Capacitor Selection**

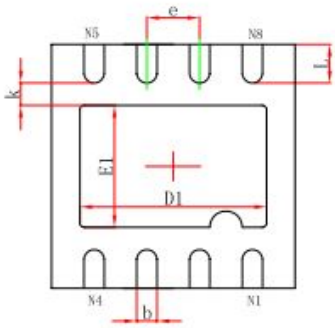
The output capacitor is required to keep the output voltage ripple small and to ensure regulation loop stability. The output capacitor must have low impedance at the switching frequency. Ceramic capacitors with X5R or X7R dielectrics are recommended due to their low ESR and high ripple current. Two 22uF ceramic can satisfy most applications.

■ Package Information

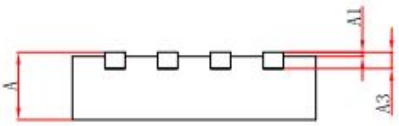
- **DFNWB3*3-8L**



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
D1	2.200	2.400	0.087	0.094
E1	1.400	1.600	0.055	0.063
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.650TYP.		0.026TYP.	
L	0.375	0.575	0.015	0.023