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## DESCRIPTION

The JW3651 is a buck boost converter targets HVDC fast discharging for power bank.

The JW3651 support 1 to 3 cells Li-ion battery, the output voltage can be programmable up to 16.0V through external resistor.

The JW3651 implements the Buck Boost converter with an H-bridge, which can maintain output regulation for input voltage whether greater or less than output voltage.

The integrated low  $R_{ds(on)}$  MOSFET minimizes physical footprint, maximizes charge/discharge efficiency, which reduces the power dissipation during discharge. Constant current control is utilized to protect the device from overshooting in unwanted conditions. Built-in loop compensation simplifies the circuit and design.

JW3651 guarantees robustness with thermal protection and battery under voltage lockout.

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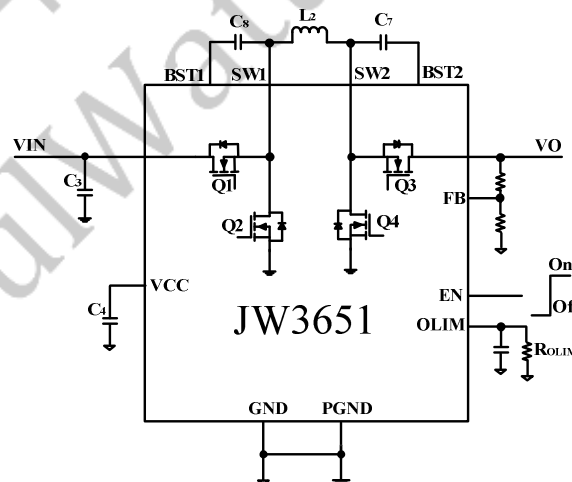
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## FEATURES

- Integrate low  $R_{DS(on)}$  power MOSFET
- Wide input range: 3.0V-16.0V, Support 1 to 3 cells battery discharge.
- Wide output range: 1.2V-16.0V
- High efficiency buck-boost transition
- Programmable output current limit, up to 3A
- Output Constant Current Control.
- Quiescent current: <50uA
- Integrate output overvoltage protection and output short protection
- Integrate thermal protection
- QFN3\*4 package

## APPLICATIONS

- Power bank systems
- USB Power Delivery
- Industrial applications
- Automotive Systems



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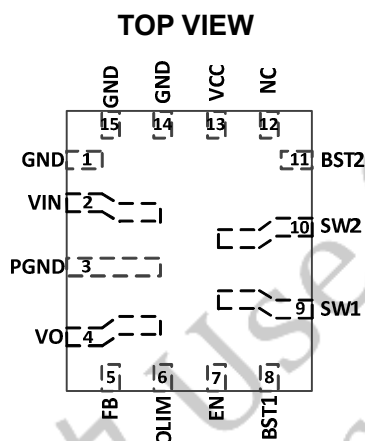
## ORDER INFORMATION

LEAD FREE FINISH	TAPE AND REEL	PACKAGE	TOP MARKING
JW3651QFNE#PBF	JW3651QFNE#TRPBF	QFN3X4-15	JW3651

Note:

JWXXXXPPPP#TRPBF  
 Part Number Package Code Pb Free Tape and Reel (If "TR" is not shown, it means Tube)

## PIN CONFIGURATION

ABSOLUTE MAXIMUM RATING<sup>111)</sup> ) )

VO, VIN, SW1, SW2 Pin	-0.3V to 20V
BST1-SW1, BST2-SW2	-0.3V to 6.5V
All Other Pins	-0.3V to 6.5V
Junction Temperature <sup>2)3)</sup>	150°C
Lead Temperature	260°C
Storage Temperature	-65°C to +150°C

## RECOMMENDED OPERATING CONDITIONS

Output Voltage VO	1.2V to 16V
Input Voltage VIN	3.0V to 16V
Operation Junction Temp (T <sub>J</sub> )	-40°C to +125°C

THERMAL PERFORMANCE<sup>444)</sup> ) )

QFN3X4-15	48...11°C/W
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Note: : :

- Exceeding these ratings may damage the device.
- The JW3651 guarantees robust performance from -40°C to 150°C junction temperature. The junction temperature range specification is assured by design, characterization and correlation with statistical process controls.
- The JW3651 includes thermal protection that is intended to protect the device in overload conditions. Thermal protection is active when junction temperature exceeds the maximum operating junction temperature. Continuous operation over the specified absolute maximum operating junction temperature may damage the device.
- Measured on JE51-7, 4-layer PCB.

## ELECTRICAL CHARACTERISTICS

VIN=12V, TA=25 ℃, unless otherwise stated						
Item	Symbol	Condition	Min.	Typ.	Max.	Units
General parameters						
VIN voltage range	VIN		3.0		16	V
VCC UVLO voltage	VCCUVLO	VIN=0V	2.3	2.4	2.5	V
BST UVLO voltage	VBSTUVLO		2.3	2.4	2.5	V
VCC output voltage	VCC		4.75	4.8	4.85	V
VCC output current limit	IVCC	VCC>2.7V	70	80	90	mA
		VCC<2.7V	15	20	25	mA
Supply current in shut-down mode	IQ	VIN=8V, EN=0V	40	50	60	μA
EN Logic HIGH	VENH	VIN=8V	1.5			V
EN Logic LOW	VENL	VIN=8V			0.4	V
Buck top switch on-resistance	RdsbkTG			20	28	mΩ
Buck bottom switch on-resistance	RdsbkBG			20	28	mΩ
Boost top switch on-resistance	RdsbstTG			20	28	mΩ
Boost bottom switch on-resistance	RdsbstBG			20	28	mΩ
VIN UVLO voltage	VIN_UVLO	rising	2.94	3.0	3.06	V
		falling	2.64	2.7	2.76	V
Feedback voltage	VFB		1.083	1.1	1.117	V
OLIM pin output current sense ratio	KOLIM		4.5	5	5.5	μA/A
OLIM pin regulate voltage	VOLIM		394	400	406	mV
Output average current limit	IO_LIM	ROLIM=40KΩ	1.8	2	2.2	A
Buck region, (IL Valley)	ICOMP(MAX)		5.4	6	6.6	A
Boost region, (IL Peak)			6.3	7	7.7	
Protection						
VO OVP threshold	VO_OVP	rising	16.8	17.4	17.9	V
		falling	15.15	15.8	16.35	V
VO OVP deglitch time	toVP		1.8	2	2.2	μS
Thermal shutdown threshold <sup>5)</sup>	TSHUT			150		℃
Thermal recovery threshold <sup>5)</sup>	TREC			130		℃

## Notes:

5) Guaranteed by design.

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## PIN DESCRIPTION

Pin No.	Name	Description
1,14,15	GND	Signal GND.
2	VIN	Input pin, place bypass capacitor close to this pin.
3	PGND	Power Ground.
4	VO	Output pin, place bypass capacitor close to this pin.
5	FB	Output feedback pin.
6	OLIM	Output current limit program pin. Connect a resistor to GND to set the maximum average current. And in the light load, it could be output current detection pin.
7	EN	Enable control pin. In discharge mode, the EN pin rises above 1.5V, the IC is turned on.
8	BST2	VO side bootstrap supply pin for top switch. 0.1uF capacitor is connected between BST2 and SW2 pins.
9	SW2	VO side power switching node. connect to SW2 with inductor
10	SW1	VIN side power switching node.
11	BST1	VIN side bootstrap supply pin for top switch. 0.1uF capacitor is connected between BST1 and SW1 pins.
12	NC	No connection, connect this pin to GND.
13	VCC	4.8V LDO for power driver and internal circuit. Must be bypassed to GND with a minimum of 10uF ceramic capacitor for stable operation.

Notes:

Highlighted pins are high current pins

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## FUNCTIONAL DESCRIPTION

JW3651 is a monolithic buck-boost DC to DC converter that can operate over a wide input voltage range of 3.0V to 16V. The output voltage can be programmed between 1.2V to 16V and deliver 3A of load current. Internal, low  $R_{DS(on)}$  N-channel power switches reduce the solution complexity and efficiency.

### Flexible Buck-Boost Converter

The JW3651 contains flexible buck-boost converter for either buck or boost converter. When VIN voltage is higher than output voltage, it is a buck converter. When input voltage is lower than VIN voltage, it is a boost converter. The DC-DC converter utilizes proprietary single inductor current-mode control to guarantee smooth transition between buck and boost operation with better dynamic response and cycle-by-cycle current protection.

### BST UVLO

If the BST1-SW1 or BST2-SW2 voltage is lower than BST UVLO Voltage, the switch is turned off.

### Discharge Mode

In discharge mode, JW3651 regulates the output voltage and output current.

#### Output current sensing

The JW3651 senses the output current and output through OLIM when the output current is less than  $I_{OLL}$ . If the output current is larger than  $I_{OLL}$ , the OLIM output a fixed voltage, the output current limit can be programmable through the resistor on OLIM pin.

#### VIN UVLO

When VIN voltage decreases to  $V_{IN\_UVLO}$ , the discharging process is terminated. When the VIN voltage recovers and is larger than  $V_{IN\_UVLO}$ ,

the JW3651 can re-discharge if the EN is still high.

#### Output constant current control

In discharge mode, the output voltage is regulated to setting value which can be programmable through FB pin.

$$V_o = \frac{1.1(V) \times (R_1 + R_2)}{R_2}$$

The output current limit can be programmable by  $R_{OLIM}$ . The maximum output current limit is up to 3.4A.

$$I_{OLIM} = \frac{0.4(V)}{R_{OLIM} (K \Omega)} \times 0.2 (A / uA)$$

If the output current equals to the  $I_{O\_LIMIT}$ , the output current loop begins to work, it turns down output voltage to limit the output power.

When output is shorted to ground, the JW3651 works as a buck converter, the output current is continuously sensed and limited to  $I_{O\_LIMIT}$ . When the output short is removed, the regulator comes into normal operation again.

### Thermal Control

When the junction temperature of the JW3651 rises above 135°C, it begins to reduce the output power to prevent the temperature from rising further. If the junction temperature of the JW3651 rises above 150°C, the discharging process stops.

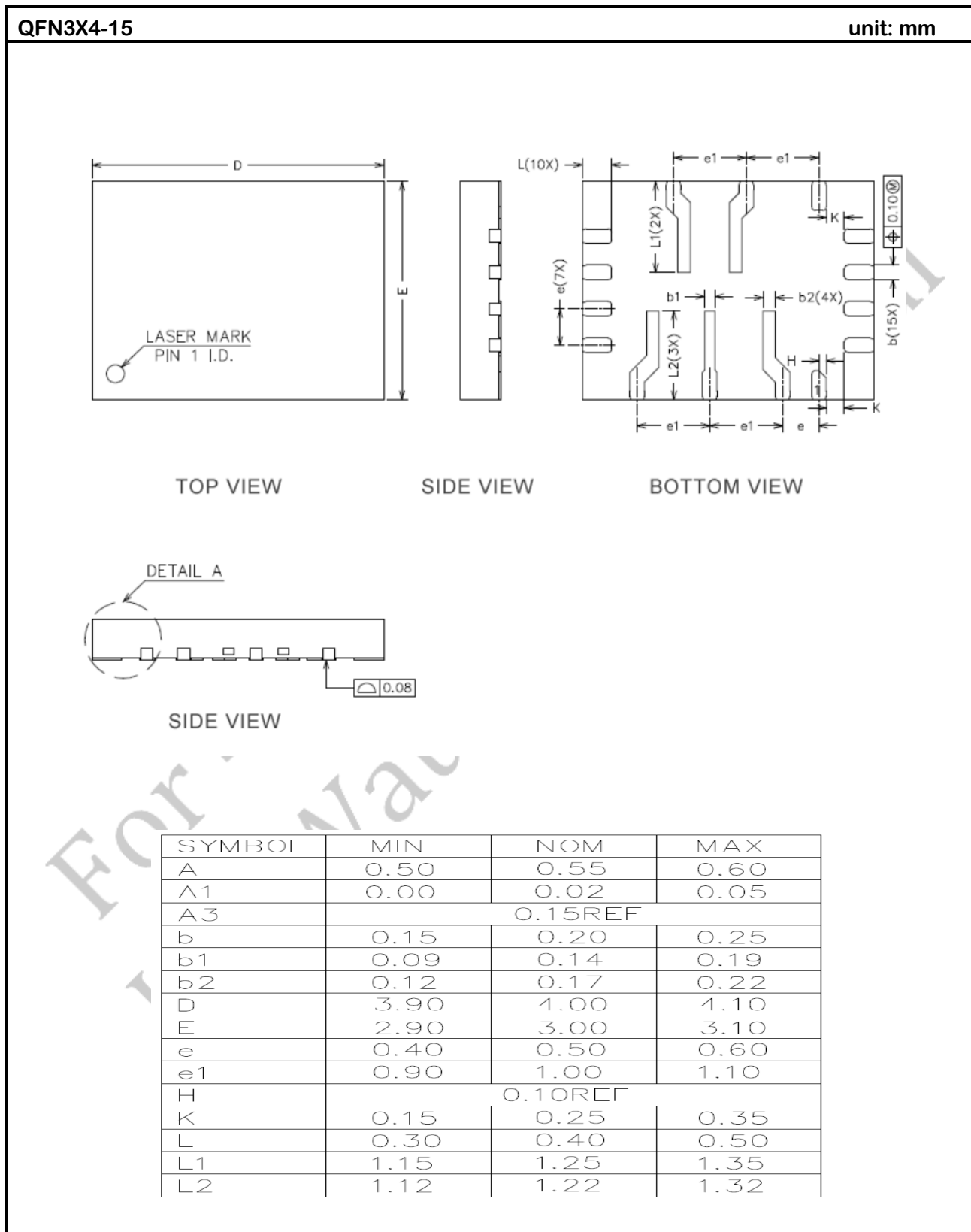
### Shut-down Mode

The JW3651 shuts down when voltage at EN pin is below 0.4V. The entire regulator is off.

### Output Over Voltage Protection

If the output voltage is larger than  $V_{O\_OVP}$  rising threshold, the device stops switching. Until the output voltage is less than  $V_{O\_OVP}$  falling threshold, the device re-starts switching again.

## PACKAGE OUTLINE



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