JOULWATT TECHNOLOGY

2A, 40V Synchronous Rectified

Step-Down Converter

FEATURES

- 3.6V to 40V operating input range
  2A output current
- Up to 94% efficiency
- High efficiency (>78%) at light load
- Internal Soft-Start
- Adjustable switching frequency
- Input under voltage lockout
- Available in thermally enhanced ESOP8 package
- Start-up current run-away protection
- Short circuit protection
- Thermal protection

DESCRIPTION

The JW5015 is a current mode monolithic buck switching regulator. Operating with an input range of 3.6-40V, the JW5015 delivers 2A of continuous output current with two integrated N-Channel MOSFETs. The internal synchronous power switches provide high efficiency without the use of an external Schottky diode. At light loads, regulators operate in low frequency to maintain high efficiency and low output ripple. Current mode control provides tight load transient response and cycle-by-cycle current limit.

The JW5015 guarantees robustness with short-circuit protection, thermal protection, start-up current run-away protection, and input under voltage lockout.

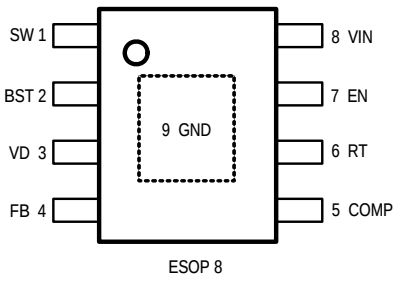
The JW5015 is available in 8-pin ESOP package, which provides a compact solution with minimal external components. The package has an exposed pad for low thermal resistance.

APPLICATIONS

- Distributed Power Systems
- Networking Systems
- FPGA, DSP, ASIC Power Supplies
- Green Electronics/ Appliances
- Notebook Computers

PIN CONFIGURATION

TOP VIEW



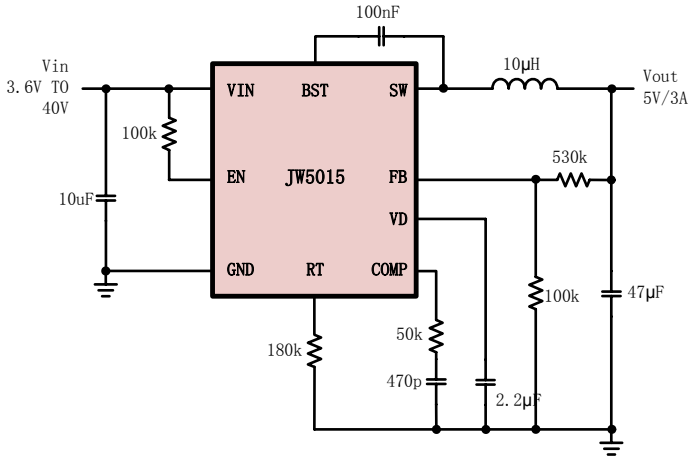
EXPOSED PAD(PIN 9) IS GND, MUST BE SOLDERED TO PCB

ORDER INFORMATION

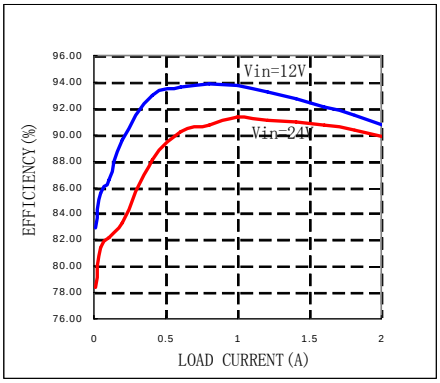
PART MARKING	PACKAGE DESCRIPTION	TEMPERATURE RANGE
JW5015	ESOP8	-40°C to +85°C

TYPICAL APPLICATION

5V/3A Step Down Regulators



Efficiency vs Load Current (Vout = 5V)



ABSOLUTE MAXIMUM RATING

Item	Extreme value
VIN, EN	-0.3V to +40V
SW	-0.3V to +40V
BST	SW-0.3V to SW+5V
All other pins	-0.3V to 6V
Junction Temperature	125 ºC
Lead Temperature	260 ºC
Storage Temperature	－65 ºC to +150 ºC

RECOMMENDED OPERATING CONDITIONS

Item	Extreme value
Input Voltage VIN	3.6V to 40V
Output voltage Vout	0.8V to 37V
Operating Junction Temperature (T_J)	-40 °C to +85 °C

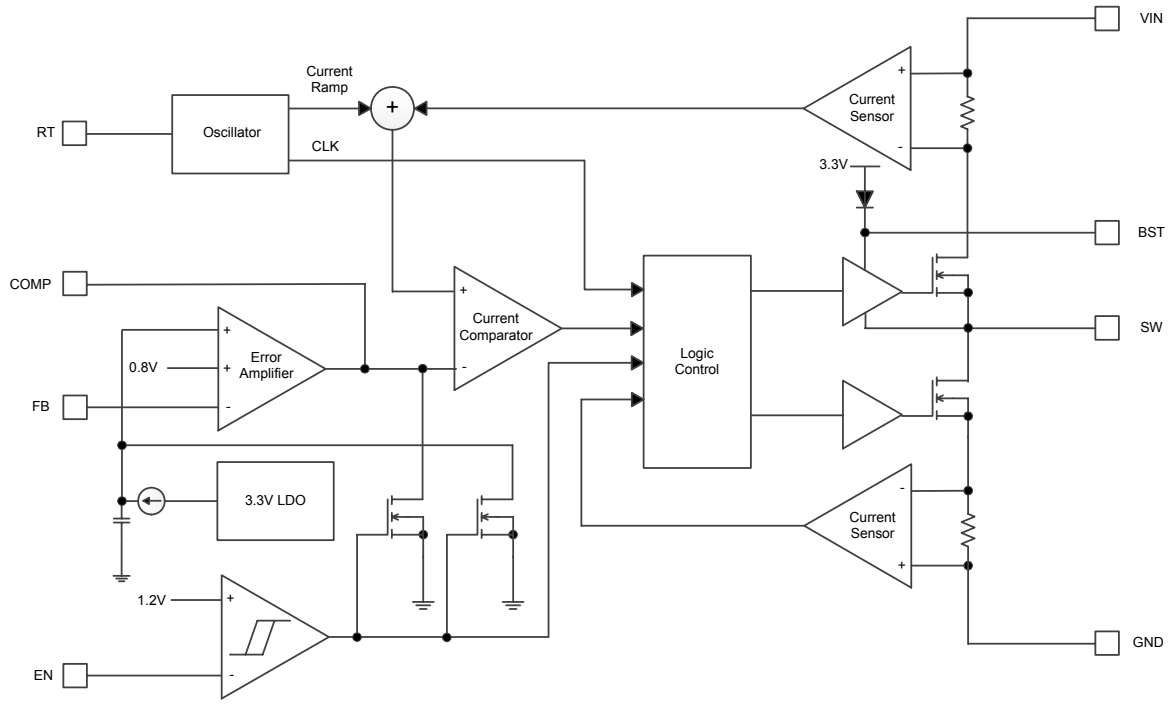
ELECTRICAL CHARATERISTICS

V_{IN} = 24V, T_A = 25ºC, unless otherwise stated.						
Item	**Symbol**	**Condition**	**Min.**	**Typ.**	**Max.**	**Units**
V_{IN} Undervoltage Lockout Thershold	V_{IN_MIN}	V_{IN} falling		3.6		V
V_{IN} Undervoltage Lockout Hysteresis	$V_{IN\_MIN\_HYST}$	V_{IN} rising		160		mV
Shutdown Supply Current	I_{SD}	V_{EN}=0V		0.07		μA
Supply Current	I_Q	V_{EN}=5V, V_{FB}=1V		74		μA
Feedback Voltage	V_{FB}	3.6V<V_{VIN}<40V		0.8		V
Error Amplifier Transconductance	G_{EA}	V_{comp} = 1.5V		250		uA/V
Maximum COMP Sourcing Current	$I_{COMP\_MAX\_OUT}$	V_{comp} = 1V		25		uA
Maximum COMP Sinking Current	$I_{COMP\_MAX\_IN}$	V_{comp} = 3V		25		uA
Top Switch Resistance	$R_{DS(ON)T}$			126		mΩ
Bottom Switch Resistance	$R_{DS(ON)B}$			63		mΩ
Top Switch Leakage Current	I_{LEAK_TOP}	V_{IN}=40V, V_{EN}=0V, V_{SW}=0V		0.2		uA
Bottom Switch Leakage Current	I_{LEAK_BOT}	V_{IN}= V_{SW} = 40V, V_{EN}=0V		0.7		uA
Top Switch Current Limit	I_{LIM_TOP}	Minimum Duty Cycle		4.5		A
Switch Frequency	F_{SW}	R_{RT} = 180k		480		kHz
Minimum On Time	T_{ON_MIN}			117		ns
Minimum Off Time	T_{OFF_MIN}	V_{FB}=0V		112		ns
EN shut down threshold voltage	V_{EN_TH}	V_{EN} falling, FB=0V		1.2		V
EN shut down hysteresis	V_{EN_HYST}	V_{EN} rising, FB=0V		120		mV
Thermal Shutdown	T_{TSD}			132		°C

PIN DESCRIPTION

SOP8 Pin	Name	Description
1	SW	SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load.
2	BST	Bootstrap pin for top switch. A 0.01uF or larger capacitor should be connected between this pin and the SW pin to supply current to the top switch and top switch driver.
3	VD	Output of the internal LDO. A capacitor of 2.2uF or larger should be connected at VD to ground.
4	FB	Output feedback pin. FB senses the output voltage and is regulated by the control loop to 0.8V. Connect a resistive divider at FB.
5	COMP	Compensation pin. COMP is used to compensate the regulation control loop. Connect a series RC network from COMP to GND to compensate the regulation control loop.
6	RT	Connect a resistor at RT pin to ground to set the switching frequency.
7	EN	Drive EN pin high to turn on the regulator and low to turn off the regulator.
8	VIN	Input voltage pin. VIN supplies power to the IC. Connect a 3.6V to 40V supply to VIN and bypass VIN to GND with a suitably large capacitor to eliminate noise on the input to the IC.
9	GND	Ground.

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

The JW5015 is a synchronous, current-mode, step-down regulator. It regulates input voltages from 3.6V to 40V down to an output voltage as low as 0.8V, and is capable of supplying up to 2A of load current.

Current-Mode Control

The JW5015 utilizes current-mode control to regulate the output voltage. The output voltage is measured at the FB pin through a resistive voltage divider and the error is amplified by the internal transconductance error amplifier. COMP pin is output of the internal error amplifier and is compared to the switch current measured internally to control the output current limit.

PFM Mode

The JW5015 operates in PFM mode at light load. In PFM mode, switch frequency is continuously controlled in proportion to the load current, i.e. switch frequency is decreased when load current drops to boost power efficiency at light load by reducing switch-loss, while switch frequency is increased when load current rises, minimizing both load current and output voltage ripples.

Shut-Down Mode

The JW5015 operates in shut-down mode when voltage at EN pin is driven below 0.3V. In shut-down mode, the entire regulator is off and the supply current consumed by the JW5015 drops below 0.1uA.

Power Switch

N-Channel MOSFET switches are integrated on the JW5015 to down convert the input voltage to the regulated output voltage. Since the top MOSFET needs a gate voltage great than the input voltage, a boost capacitor connected between BST and SW pins is required to drive the gate of the top switch. The boost capacitor is charged by the internal 3.3V rail when SW is low.

Vin Under-Voltage Protection

A resistive divider can be connected between Vin and ground, with the central tap connected to EN, so that when Vin drops to the pre-set value, EN drops below 1.2V to trigger input under voltage lockout protection.

Vout Over-Voltage Protection

When output voltage rises above its regulated value, both the top and bottom power switches are turned off. Switching of the internal clock is also disabled. Only when output voltage falls to its regulated value can the internal clock, top power switch, and bottom power switch become active again.

Output Current Run-Away Protection

At start-up, due to the high voltage at input and low voltage at output, current inertia of the output inductance can be easily built up, resulting in a large start-up output current. A valley current limit is designed in the JW5015 so that only when output current drops below the valley current limit can the bottom power switch be turned off. By such control mechanism, the output current at start-up is well controlled.

Output Short Protection

When output is shorted to ground, output current rapidly reaches its peak current limit and the top power switch is turned off. Right after the top power switch is turned off, the bottom power switch is turned on and stay on until the output

current falls below the valley current limit. When output current is below the valley current limit, the top power switch will be turned on again and if the output short is still present, the top power switch is turned off when the peak current limit is reached and the bottom power switch is turned on. This cycle goes on until the output short is removed and the regulator comes into normal operation again.

Thermal Protection

When the temperature of the JW5015 rises above 132°C, it is forced into thermal shut-down. Only when core temperature drops below 125°C can the regulator becomes active again.

PACKAGE OUTLINE

ESOP8 UNIT: mm