

### Dynamic Response and Ultra-low Standby Power All integrated off-line CV Regulator

*Parameters Subject to Change Without Notice*

#### DESCRIPTION

The JW®BJW1536AC is a ultra-low standby power and fast dynamic response all integrated off-line constant voltage regulator for Buck topology with 500V MOSFET integrated, and with only one external component around IC for operation, which is specialized for IoT module power supply.

JWB1536AC can output 3.3V default voltage, which decreases the system cost. In light load condition, JWB1536AC operates in green mode, in which the inductor peak current and the switching frequency is lower than that of full load to improve the system efficiency and it's also suppress the audible noise problem and guarantee the fast dynamic state response.

JWB1536AC has multi-protection functions which largely enhance the safety and reliability of the system, including BST under-voltage Lockout (UVLO), short circuit protection (SCP), over load protection(OLP), pulse-by- pulse current limit and over-temperature protection (OTP).

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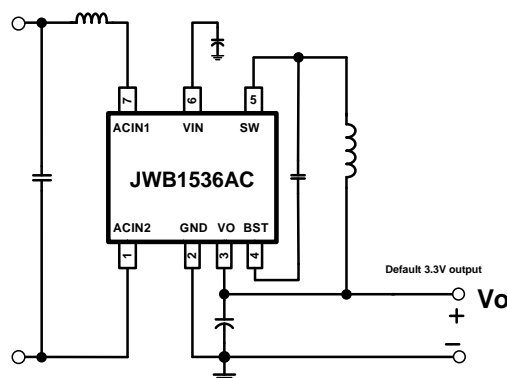
#### FEATURES

- Integrated with 800V bridge rectifier and 600V low  $V_F$  diode
- Integrated with 500V MOS
- Ultra-low standby power consumption <30mW
- Ultra-low system BOM cost
- Integrated with 500V MOS
- 3.3V default output voltage with  $\pm 3\%$  accuracy
- Fast dynamic state response, <  $\pm 5\%$
- Peak current mode control
- Built-in frequency jittering for good EMI
- High efficiency over wide operating range
- Short circuit protection and over load protection
- Pulse-by-pulse current limit
- Over temperature protection
- ASOP7 package

#### APPLICATIONS

- IoT module
- Smart lighting

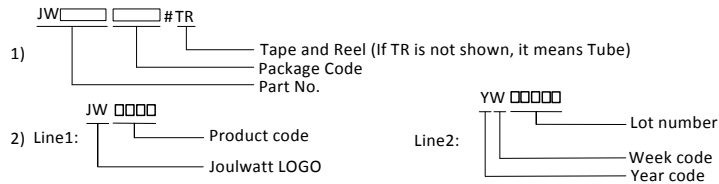
#### TYPICAL APPLICATION



## ORDER INFORMATION

DEVICE <sup>1)</sup>	PACKAGE	TOP MARKING <sup>2)</sup>	ENVIRONMENTAL <sup>3)</sup>
JWB1536ACASOPC#TR	ASOP7	JWB1536AC YW□□□□□	Green

## Notes:



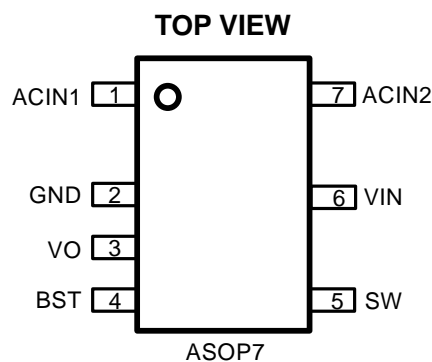
3) All Joulwatt products are packaged with Pb-free and Halogen-free materials and compliant to RoHS standards.

## DEVICE INFORMATION

DEVICE	MOS BV	MOS RDSON	OUTPUT CURRENT	
			Continue output	Pulse output
JWB1536ACASOPC#TR	500V	17Ω	300mA	450mA

Notes:  $T_J=25^{\circ}\text{C}$

## PIN CONFIGURATION

ABSOLUTE MAXIMUM RATING<sup>1)</sup>

VIN Voltage to SW.....	500V
BST Voltage to SW.....	9.5V
VO Voltage to GND.....	6V
Junction Temperature <sup>2) 3)</sup> .....	150°C
Lead Temperature.....	260°C
Storage Temperature.....	-65°C to +150°C
ESD Susceptibility (Human Body Model) .....	2.5kV

RECOMMENDED OPERATING CONDITIONS

VIN Voltage.....400V  
Operating Junction Temp (T<sub>J</sub>) .....-40°C to 125°C

THERMAL PERFORMANCE<sup>4)</sup>  $\theta_{JA}$

ASOP7.....150 °C/W

Note:

- 1) Exceeding these ratings may damage the device. These stress ratings do not imply function operation of the device at any other conditions beyond those indicated under RECOMMENDED OPERATING CONDITIONS.
- 2) The JWB1536AC includes thermal protection that is intended to protect the device in overload conditions. Continuous operation over the specified absolute maximum operating junction temperature may damage the device.
- 3) The device is not guaranteed to function outside of its operating conditions.
- 4) Measured on JESD51-7, 4-layer PCB.

## ELECTRICAL CHARACTERISTICS

$T_A=25^{\circ}\text{C}$ , unless otherwise stated.						
Item	Symbol	Condition	Min.	Typ.	Max.	Units
BST Charge ON Voltage	$V_{\text{BST\_ON}}$		7.5	8.0	8.5	V
BST Charge OFF Voltage	$V_{\text{BST\_OFF}}$		7.9	8.4	8.9	V
HVJFET Charge Current	$I_{\text{HV}}$		0.7	1	2	mA
Quiescent Current	$I_{\text{Q}}$	no switch, sleep mode		40	50	$\mu\text{A}$
Operation Current	$I_{\text{OP}}$	$F_s=60\text{kHz}$			120	$\mu\text{A}$
Output Voltage	$V_{\text{O}}$		3.201	3.3	3.399	V
Peak Current	$I_{\text{PK}}$		0.5	0.55	0.61	A
Maximum On Time	$T_{\text{ONMAX}}$			12		$\mu\text{s}$
Leading Edge Blanking Time	$T_{\text{LEB}}$			250	400	ns
Frequency Jittering Range <sup>5)</sup>	$\Delta f/f_{\text{OSC}}$		-8		8	%
Frequency Jittering Period <sup>5)</sup>	$T_{\text{Jit}}$			15		ms
Power MOS Breakdown Voltage	BV		500			V
Power MOS Rdson	$R_{\text{dson}}$	$V_{\text{gs}}=10\text{V}$		17		$\Omega$
Freewheel Diode BV Voltage <sup>5)</sup>	$V_{\text{BRDSD}}$		600			V
Freewheel Diode Forward Voltage Drop <sup>5)</sup>	$V_{\text{F}}$	$I_{\text{F}}=0.5\text{A}$			1.68	V
Diode Reverse Recovery Time <sup>5)</sup>	$T_{\text{RR}}$	$I_{\text{F}}=0.5\text{A}, I_{\text{R}}=1\text{A},$ $I_{\text{FF}}=0.25\text{A}$			35	ns
Bridge Diode BV Voltage <sup>5)</sup>	$V_{\text{BR\_BD}}$		800			V
Bridge Diode Forward Voltage Drop <sup>5)</sup>	$V_{\text{F\_BD}}$	$I_{\text{F}}=1\text{A}$			1.1	V
Bridge Diode Average Forward Current <sup>5)</sup>	$I_{\text{F(AV)}}$				0.5	A
Bridge Diode Peak Forward Surge Current 1ms Single Half Sine Wave	$I_{\text{FSM}}$				15	A
Over Thermal Protection Threshold <sup>5)</sup>	$T_{\text{OTP}}$			150		$^{\circ}\text{C}$
Thermal Protection Hysteresis <sup>5)</sup>	$T_{\text{OTPHYS}}$			30		$^{\circ}\text{C}$

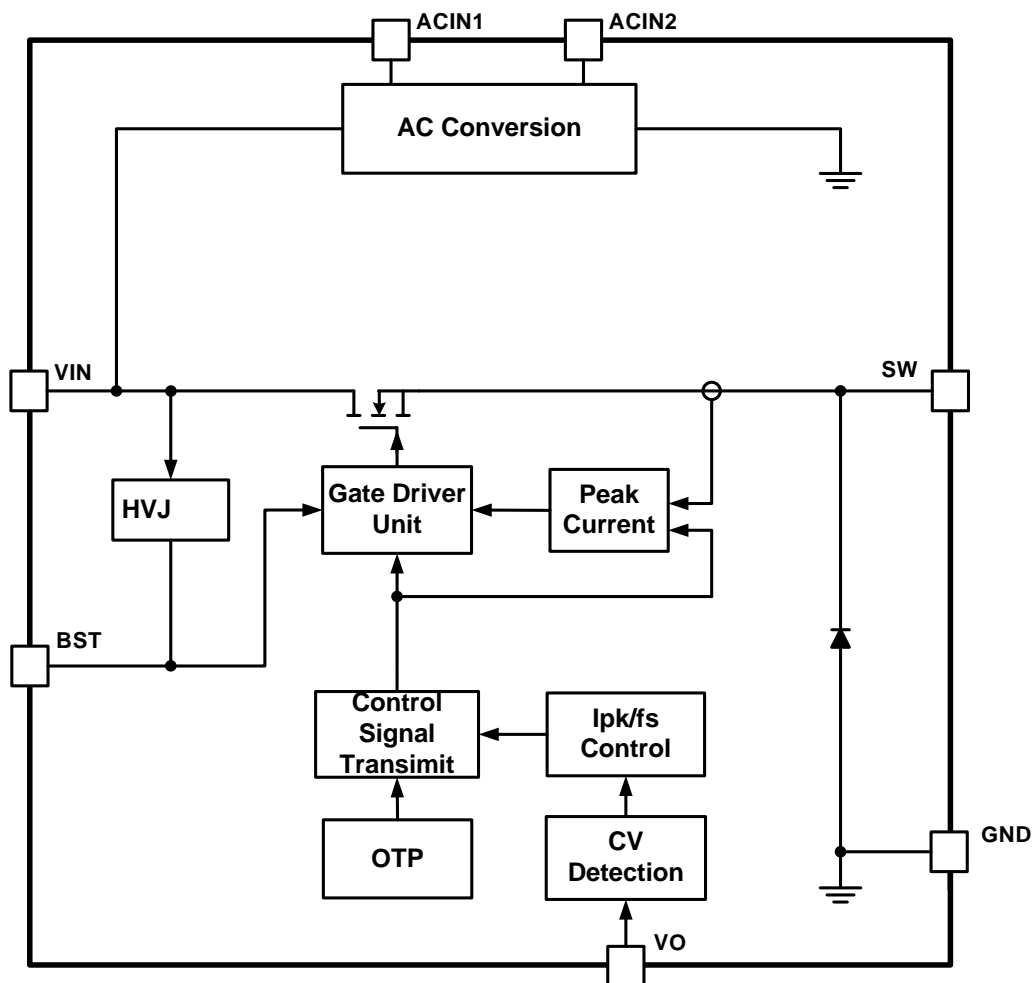
**Note:**

5) Guaranteed by design.

## PIN DESCRIPTION

Pin	Name	Description
1	ACIN1	AC voltage input pin1
2	GND	Chip ground power supply pin
3	VO	Output voltage detection
4	BST	Power supply for internal driver, 0.1uF value ceramic capacitor is ok for normal operation.
5	SW	Switching node
6	VIN	The drain of MOSFET and power supply for BST
7	ACIN2	AC voltage input pin2

## BLOCK DIAGRAM



## FUNCTIONAL DESCRIPTION

JWB1536AC is a high efficiency and high performance all integrated off-line constant voltage regulator for Buck topology, which is very suitable for IoT module application.

### Start Up

JWB1536AC can be supplied from VIN directly. When the internal high voltage(HV) power source charges BST cap up to the  $V_{BST\_OFF}$ , the gate driver starts to switch. IC enters into open loop operation until the output voltage is higher than certain voltage. Once the output voltage is lower than certain voltage and last for certain time, JWB1536AC stops switching and enters into protection.

### Peak Current Control

JWB1536AC detects the inductor peak current when internal MOS turn-on. MOS will be turned off immediately as the inductor peak reach the peak current reference. JWB1536AC will spread frequency when the peak current is higher than 1.3 reference especially at startup or short circuit condition, which is to avoid the inductor saturation and very high peak current for more reliability.

### Constant Voltage Control

The output voltage is detect by VO pin. Internal close loop controller will regulate the peak current and work frequency to keep the output voltage stable and response the dynamic load state very quickly.

### Green Mode

In light or no load condition, JWB1536AC operates in DCM which means the OFF time is very long. JWB1536AC will reduce the peak current of the inductor to minimize the power

loss. The longer Toff, the lower Ipeak, which optimize the efficiency and also decrease the power consumption especially when no-load condition.

### Short Circuit Protection(SCP)/ Over Load Protection(OLP)

In short circuit or over load condition, output voltage can't be charged to reference voltage. JWB1536AC will operate in auto-restart mode which is represented in the following description.

#### Auto-restart Mode

JWB1536AC will enter auto-restart mode if SCP/ OLP is triggered when the output voltage can't reach the reference for 120ms. The chip stops switching for 150ms and enter into restart mode repeatedly.

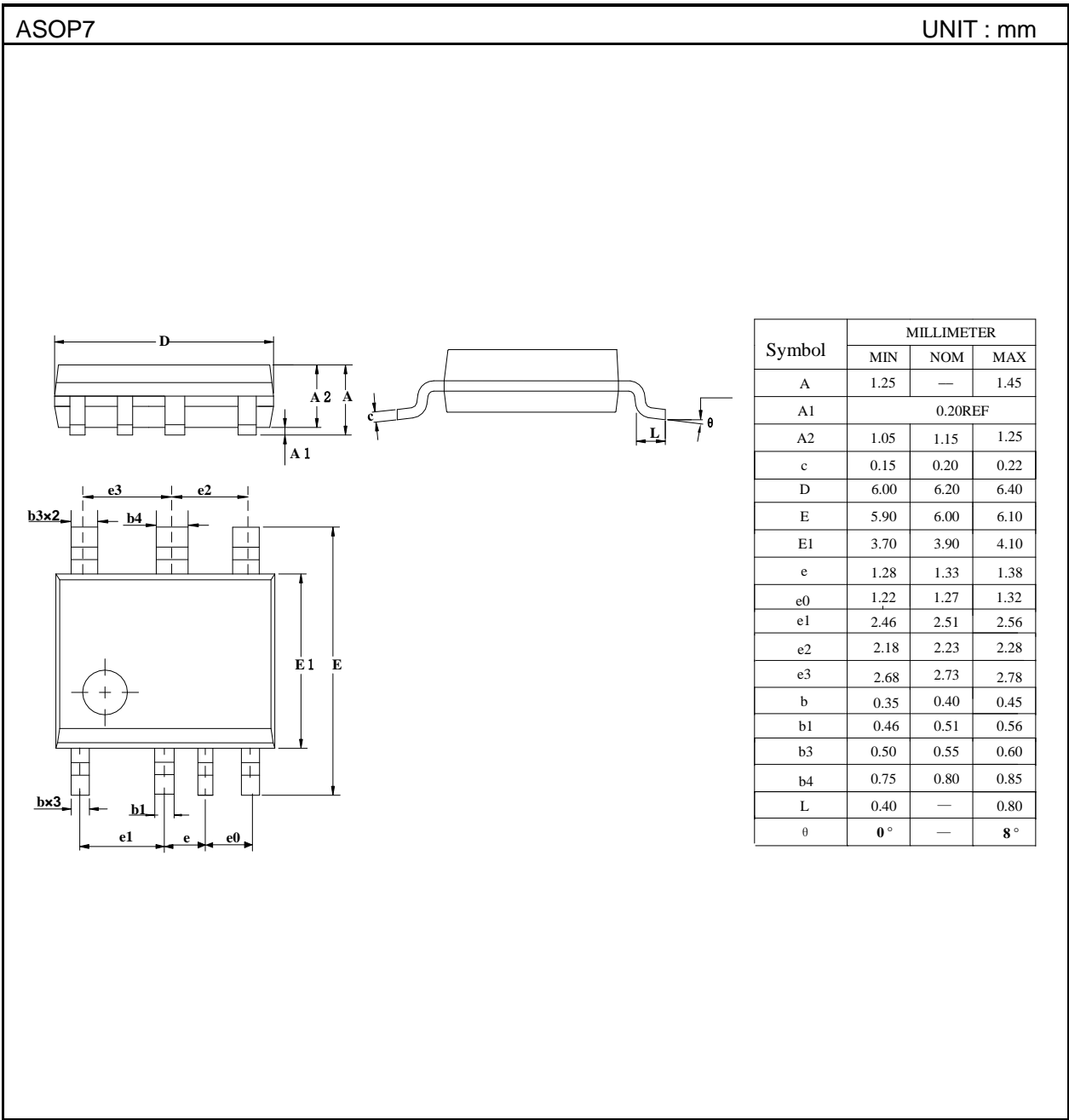
### Over Temperature Protection

When internal temperature of the chip exceeds 150°C, JWB1536AC operates in auto-restart mode to help the chip cooling.

### PCB Design

1. The BST ceramic capacitor must be located nearly to IC between the BST pin and SW.
2. Make the area of the power loop as small as possible in order to reduce the EMI radiation.
3. IC should be kept away from noisy and heating components, such as power inductor.
4. The copper connected with VIN pin could be big enough for better thermal performance.

PACKAGE OUTLINE



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