JW1536NC

Off-line CV Regulator

Fast Dynamic Response and Ultra-low Standby Power

Preliminary Specifications Subject to Change without Notice

DESCRIPTION

The JW1536NC is a ultra-low standby power and fast dynamic response off-line constant voltage regulator for Buck and Buck- Boost topology with 500V MOSFET integrated, and with only one external component around IC for operation, which is specialized for IoT module power supply. JW1536NC can output 3.3V default voltage, which decreases the system cost. In light load condition, JW1536NC 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.

JW1536NC has multi-protection functions which largely enhance the safety and reliability of the system, including VDD under-voltage Lockout (UVLO), short circuit protection (SCP), over load protection(OLP), pulse-by- pulse current limit and over-temperature protection (OTP).

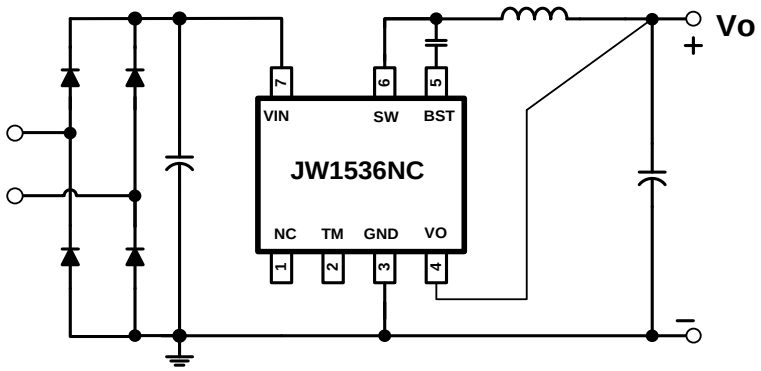
FEATURES

- Ultra-low Standby Power Consumption
- Ultra-low System BOM Cost
- 500V MOS and Freewheel Diode Integrated
- 3.3V Default Output Voltage with ±3%
- Fast Dynamic State Response
- Peak Current Mode Control
- Built-in Frequency Jittering
- High Efficiency Over Wide Operating Range
- VDD UVLO
- Short Circuit Protection and Over Load Protection
- Pulse-by-pulse Current Limit
- Over Temperature Protection
- SOP7 Package

APPLICATIONS

- IoT Module
- Smart Lighting

TYPICAL APPLICATION



ORDER INFORMATION

DEVICE[1)]	PACKAGE	TOP MARKING[2)]	ENVIRONMENTAL[3)]
JW1536NCSOPA#TR	SOP7	JW1536NC YW□□□□□	Green

Notes:

1) JW□□□□#TR
- #TR: Tape and Reel (If TR is not shown, it means Tube)
- □□□□: Package Code
- JW: Part No.

2) Line1: JW □□□□
- □□□□: Product code
- JW: JoulWatt LOGO

Line2: YW □□□□□
- □□: Lot number
- □□: Week code
- □: Year code

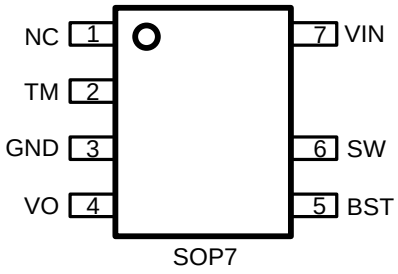
3) All JoulWatt products are packaged with Pb-free and Halogen-free materials and compliant to RoHS standards.

DEVICE INFORMATION

DEVICE	OPERATION MODE AT LIGHT LOAD	PAKAGE	MSL	STATUS
JW1536NCSOPA#TR	PFM	SOP7	MSL3	Available

PIN CONFIGURATION

TOP VIEW



SOP7

ABSOLUTE MAXIMUM RATING[1)]

VIN Voltage to SW.....500V
VIN Voltage to GND.....700V
BST Voltage to SW.....9.5V
VO Voltage to GND.....6V
Junction Temperature[2) 3)] 150ºC
Lead Temperature..... 260ºC
Storage Temperature..... -65ºC to +150ºC
ESD Susceptibility (Human Body Model) 2.5kV

RECOMMENDED OPERATING CONDITIONS

VIN Voltage.....400V

Operating Junction Temp (T_J) .....-40ºC to 125ºC

THERMAL PERFORMANCE[4)]

	θ_{JA}	$\theta_{JC(top)}$
SOP7…….....96	.....45ºC/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 JW1536NC 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 = 25ºC, unless otherwise stated.

Advance Information, not production data, subject to change without notice.

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNITS
BST Charge ON Voltage	V_{BST_ON}		7.5	8.0	8.5	V
BST Charge OFF Voltage	V_{BST_OFF}		7.9	8.4	8.9	V
HVJFET Charge Current	I_{HV}			1		mA
Quiescent Current	I_Q	no switch, sleep mode	2		4	uA
Operation Current	I_{OP}	Fs=30kHz			120	uA
Output Voltage	V_O		3.201	3.3	3.399	V
Peak Current	I_{PK}	JW1536NC	0.23	0.25	0.27	A
Maximum On Time	T_{ONMAX}			12		μs
Leading Edge Blanking Time	T_{LEB}			250	400	ns
Oscillator Frequency	f_{osc}			30		kHz
Frequency Jittering Range	$\lvert \pm \Delta f/f_{OSC} \rvert$			8		%
Frequency Jittering Period	T_{Jit}			15		ms
Power MOS Breakdown Voltage	BV		500			V
Power MOS Rdson	Rdson	Vgs=10V		26	30	Ω
Over Thermal Protection Threshold[5)]	T_{OTP}			150		℃
Thermal Protection Hysteresis[5)]	T_{OTPHYS}			30		℃

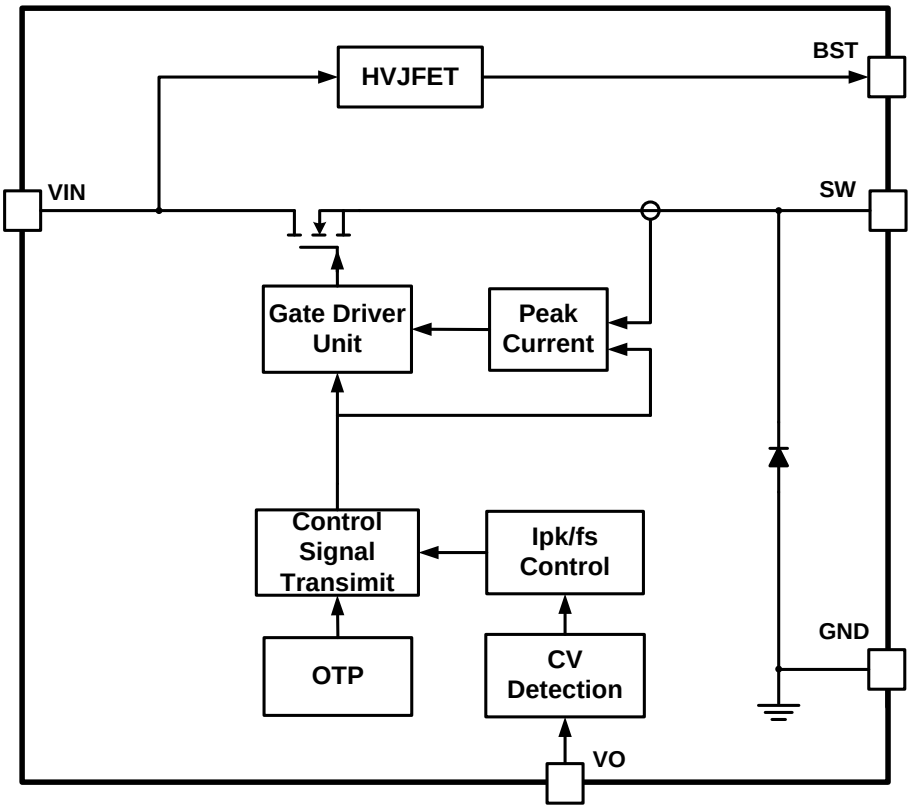
Note：

6) Guaranteed by design.

PIN DESCRIPTION

PIN SOP8	NAME	DESCRIPTION
1	NC	
2	TM	Test mode pin, TM pin connect to GND in application.
3	GND	Chip ground power supply pin
4	VO	Output voltage detection
5	BST	Power supply for internal driver, 0.1uF~0.47uF value ceramic capacitor is ok for normal operation.
6	SW	Switching node
7	VIN	The drain of MOSFET and power supply for BST

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

JW1536NC is a high efficiency and high performance off-line constant voltage regulator for Buck and Buck- Boost topology.

Start Up

JW1536NC can be supplied from VIN directly. When the internal high voltage(HV) power souse charges BST cap up to the V_{BST_ST}, 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 reference voltage lasting for certain time, JW1536NC stops switching and enters into protection.

Peak Current Control

JW1536NC 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. JW1536NC will spread frequency when the peak current is higher than 1.3 reference peak current 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 detected 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, JW1536NC operates in DCM which means the OFF time is very long. JW1536NC will reduce the peak current of the inductor to minimize the power loss. The longer Toff time, 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. JW1536NC will operate in auto-restart mode which is represented in the following description.

Auto-restart Mode

JW1536NC will enter auto-restart mode if SCP/ OLP is triggered when the output voltage can't reach the reference for certain time. The chip stops switching for very long time and enter into restart mode repeatedly.

Over Temperature Protection

When internal temperature of the chip exceeds T_{OTP}, JW1536NC 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.

REFERENCE DESIGN

Note: Information in the following reference design sections is not part of JoulWatt component specification. Customers are responsible for determining suitability of components chosen for their purposes and should validate their design implementation to make sure the proper system functionality.

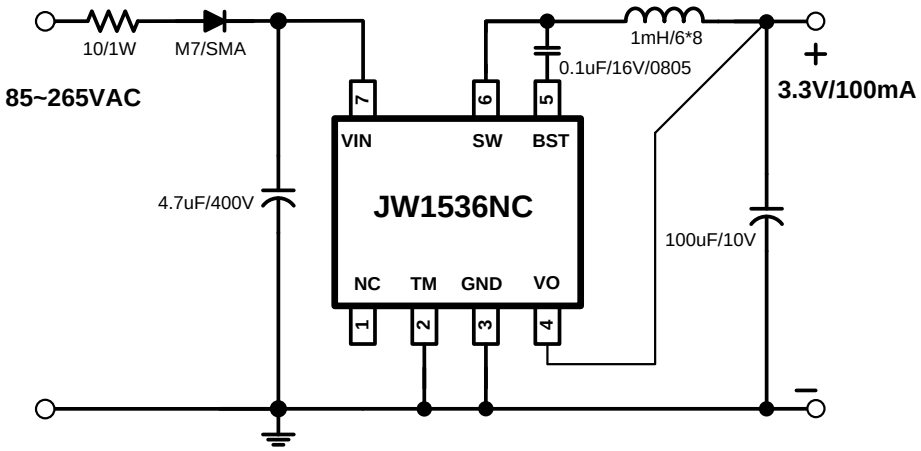
Reference 1:

The reference design is suitable for non-isolated buck power supply default 3.3V output, using JW1536NC.

V_{IN}: 85~265VAC

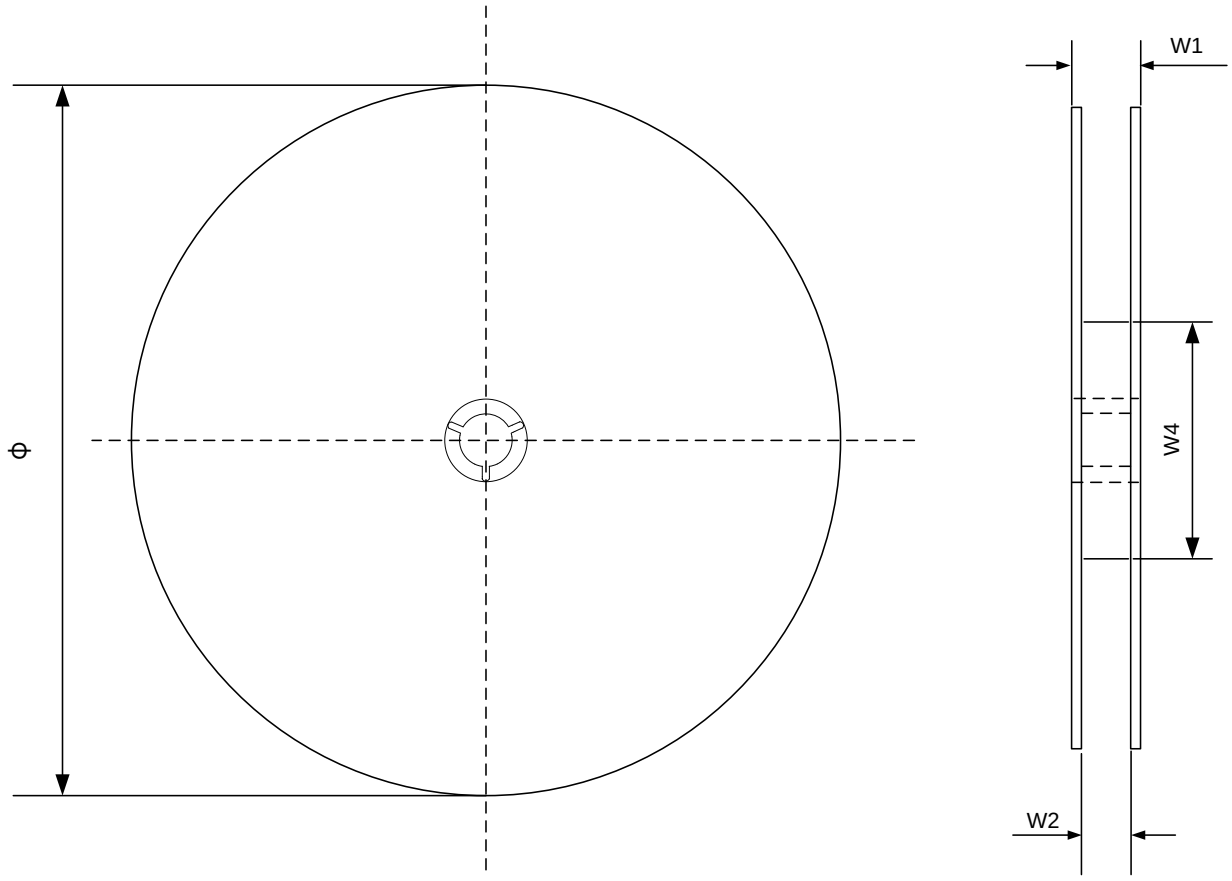
V_{OUT}: 3.3V

I_{OUT}: 100mA



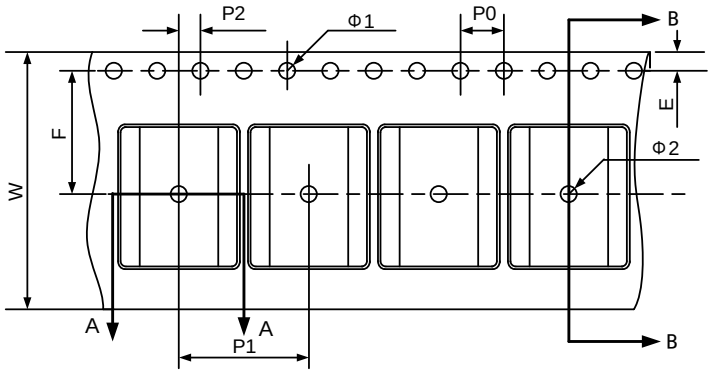
TAPE AND REEL INFORMATION

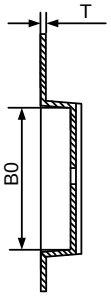
Reel UNIT: mm



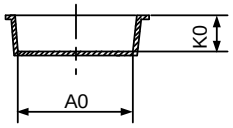
Package	Diameter Φ	Thickness W1	Width W2	W4
SOP7	330±2	17.6±2	12.4±2	100±2

Carrier Tape UNIT: mm





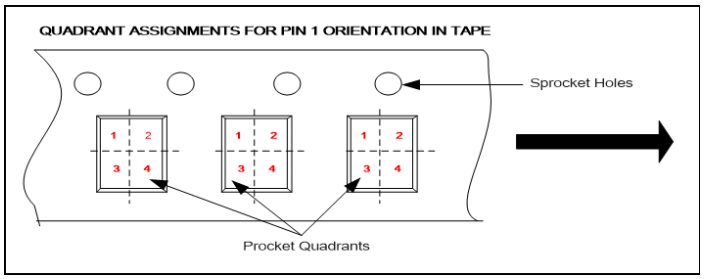
SECTION B-B



SECTION A-A

Note :

1) The carrier type is black, and colorless transparent.
2) Carrier camber is within 1mm in 100mm.
3) 10 pocket hole pitch cumulative tolerance:±0.20.
4) All dimensions are in mm.

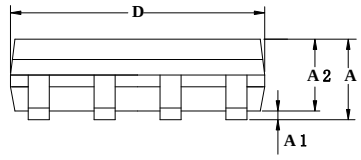


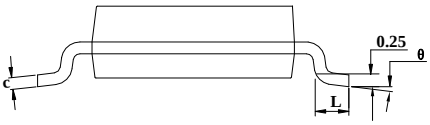
Package Type	Pin1 Quadrant
SOP7	1

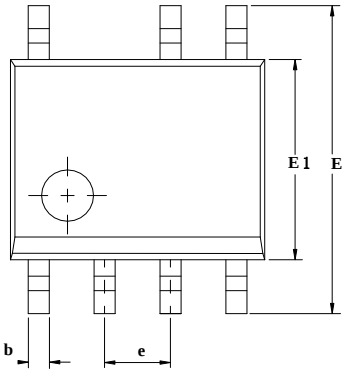
Package	Tape dimension (mm)											
	P0	P2	P1	A0	B0	W	T	K0	Φ1	Φ2	E	F
SOP7	4.0±0.1	2.0±0.1	8.0±0.1	6.40±0.3	5.35±0.3	12.0±0.3	0.25±0.2	2.00±0.2	1.50min	1.50min	1.75±0.1	5.50±0.10

PACKAGE OUTLINE

SOP7 UNIT: mm







Symbol	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.05	0.15	0.25
A2	1.25	1.40	1.65
b	0.32	0.42	0.52
c	0.10	0.20	0.30
D	4.50	5.00	5.50
E	5.50	6.00	6.50
E1	3.50	3.90	4.30
e	1.27TYP		
L	0.40	—	1.27
θ	0°	—	8°

IMPORTANT NOTICE

- **Joulwatt Technology Co.,Ltd reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein.**
- **Any unauthorized redistribution or copy of this document for any purpose is strictly forbidden.**
- **Joulwatt Technology Co.,Ltd does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.**
- **JOULWATT TECHNOLOGY CO.,LTD PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, SAFETY INFORMATION AND OTHER RESOURCES, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.**