# JW1532N5

## High Efficiency Off-line CV Regulator

## DESCRIPTION

The JW1532N5 is a high efficiency low cost off-line constant voltage regulator for Buck and Buck-Boost topology with 650V MOSFET.

JW1532N5 can output 5V default voltage with few external components, which decreases the system cost. In light load condition, JW1532N5 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 the reference voltage is decreased to ensure good load regulation.

JW1532N5 has multi-protection functions which largely enhance the safety and reliability of the system, including VDD under-voltage Lockout (UVLO), short circuit protection (SCP), pulse-by-pulse current limit, over load protection (OLP) and over-temperature protection (OTP).



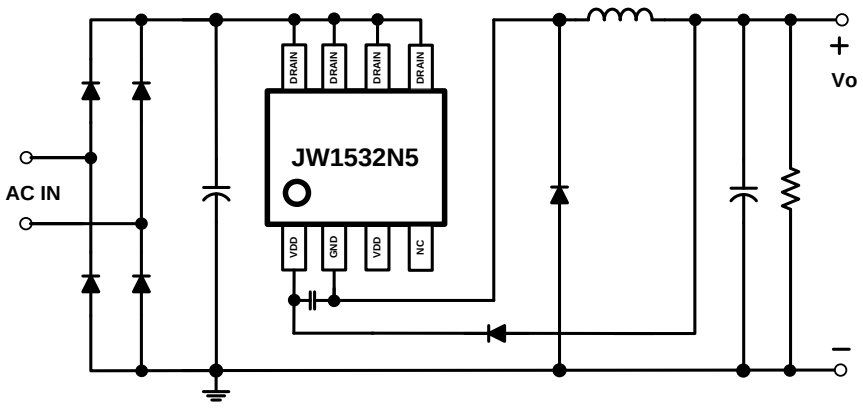
## FEATURES

- Ultra Low System BOM Cost
- Integrated with 650V MOSFET
- 5V Default Output Voltage
- Support Buck and Buck-boost Topology
- Peak Current Mode Control
- Frequency Jittering for Good EMC
- High Efficiency Over Wide Operating Range
- Output Voltage Load Regulation Compensation
- VDD UVLO
- Short Circuit Protection
- Pulse-by-pulse Current Limit
- Over Temperature Protection
- SOP8 Package

## APPLICATIONS

- Home Appliances
- Standby Power
- Consumer Electronics

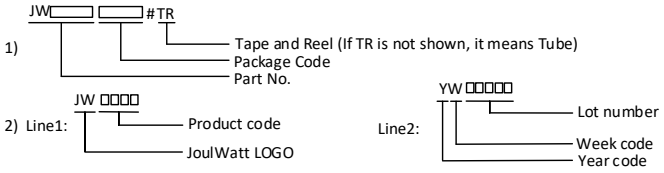
## TYPICAL APPLICATION



## ORDER INFORMATION

| DEVICE[1)] | PACKAGE | TOP MARKING[2)] | ENVIRONMENTAL[3)] |
|---|---|---|---|
| JW1532N5SOPB#TR | SOP8 | JW1532N5<br>YW□□□□□ | Green |

**Notes:**

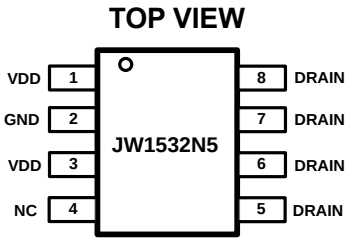



3) All JoulWatt products are packaged with Pb-free and Halogen-free materials and compliant to RoHS standards.

## DEVICE INFORMATION

| DEVICE | OPERATION MODE AT LIGHT LOAD | PAKAGE | MSL | STATUS |
|---|---|---|---|---|
| JW1532N5SOPB#TR | PFM | SOP8 | MSL3 | Available |

## PIN CONFIGURATION




## ABSOLUTE MAXIMUM RATING[1)]

VDD Voltage to SOURCE.....-0.3V to 7V
DRAIN Voltage to SOURCE.....-0.3V to 650V
Junction Temperature[2) 3)] ..... 150ºC
Lead Temperature..... 260ºC
Storage Temperature..... -65ºC to +150ºC
ESD Susceptibility (Human Body Model) ..... 2.5kV

## RECOMMENDED OPERATING CONDITIONS

DRAIN Voltage.....600V

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

| Package | Recommended MAX Output Current |
|---|---|
| SOP8 | 150mA |

## THERMAL PERFORMANCE[4)]

| | $\theta_{JA}$ | $\theta_{JC(top)}$ |
|---|---|---|
| SOP8……..... | 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 JW1532N5 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.*

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| VDD Quiescent Current | $I_Q$ | $V_{DD\_ST}$ -1V | 100 | 110 | 120 | μA |
| Operation Current | $I_{OP}$ | $V_{DD\_ST}$ +1V | 170 | 190 | 210 | uA |
| VDD Charge Current | $I_{CH}$ | VDD=5V | 0.9 | 1 | 1.2 | mA |
| VDD Startup Voltage | $V_{DD\_ST}$ | | 5.2 | 5.35 | 5.5 | V |
| VDD Under Voltage Lockout | $V_{DD\_UVLO}$ | | 3.4 | 3.6 | 3.8 | V |
| VDD Clamping Voltage | $V_{CLP}$ | Sink current =5mA | 7.5 | 7.75 | 7.95 | V |
| VDD Feedback Reference | $V_{DDREF}$ | | 5.3 | 5.5 | 5.7 | V |
| Peak Current Limit | $I_{PK}$ | | 0.195 | 0.23 | 0.265 | A |
| Oscillator Frequency | $f_{osc}$ | | 36 | 43 | 50 | kHz |
| Frequency Jittering Range[5)] | $\lvert \pm \triangle f/f_{OSC} \rvert$ | | | 8 | | % |
| Frequency Jittering Period[5)] | $T_{Jit}$ | | | 15 | | ms |
| Maximum On Time | $T_{ONMAX}$ | | 7.7 | 8.7 | 9.7 | μs |
| Leading Edge Blanking Time | $T_{LEB}$ | | | 400 | | ns |
| MOS Breakdown Voltage | BV | | 650 | | | V |
| MOS Rdson | Rdson | Vgs=10V | | 30 | | Ω |
| Over Thermal Protection Threshold[5)] | | | | 150 | | ℃ |
| Over Thermal Protection Recovery Hysteresis[5)] | | | | 30 | | ℃ |

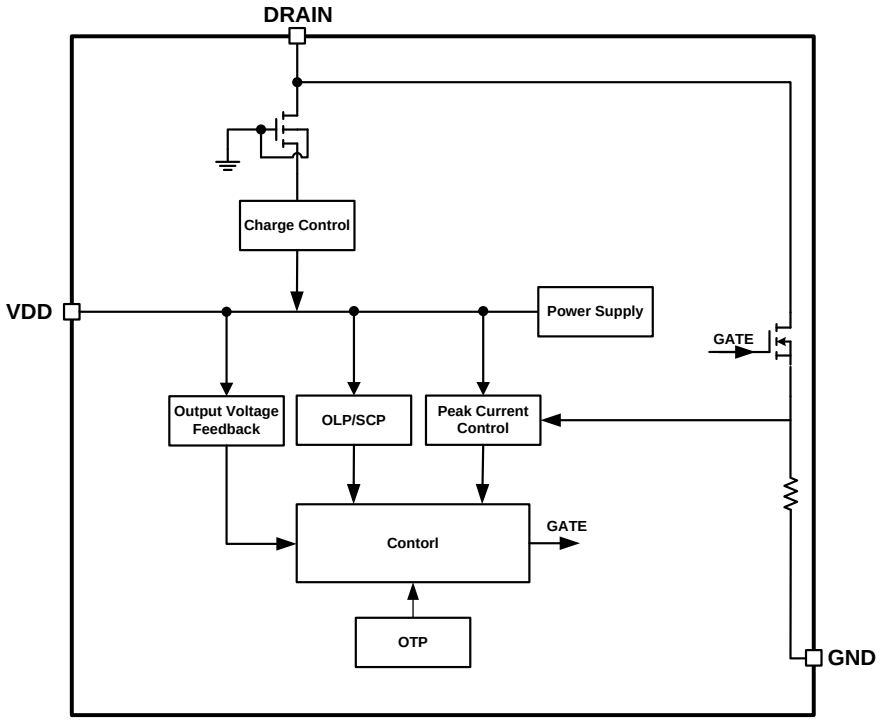
**Note：**

**5)** Guaranteed by design.

## PIN DESCRIPTION

| PIN SOP8 | NAME | DESCRIPTION |
|---|---|---|
| 1 | VDD | IC power supply and output voltage feedback |
| 2 | GND | IC ground |
| 3 | VDD | IC power supply and output voltage feedback |
| 4 | NC | |
| 5 | DRAIN | Internal MOS drain and HV power supply |
| 6 | DRAIN | Internal MOS drain and HV power supply |
| 7 | DRAIN | Internal MOS drain and HV power supply |
| 8 | DRAIN | Internal MOS drain and HV power supply |

## BLOCK DIAGRAM



# FUNCTIONAL DESCRIPTION

JW1532N5 is a high efficiency low cost off-line constant voltage regulator for Buck and Buck-Boost topology.

## Start Up

JW1532N5 can be supplied from MOS DRAIN directly. When the internal high voltage (HV) power souse charges VDD up to the $V_{DD\_ST}$, the gate driver starts to switch. VDD will be powered by output voltage in steady state. Once the voltage of VDD is lower than $V_{DD\_UVLO}$, JW1532N5 stops switching.

## Peak Current Control

JW1532N5 has the default peak current for output current. And it's also the SCP limit peak current for abnormal state such as inductance short.

## Constant Voltage Control

The output voltage is sensed by VDD pin and adjusted by internal control compensation loop automatically.

The switching frequency of JW1532N5 is fixed to $f_{osc}$ with $\pm$ 8% Jittering to improve the EMI performance.

## Green Mode

In light or no load condition, JW1532N5 operates in DCM which means the OFF time is very long. JW1532N5 will reduce the peak current of the inductor to minimize the power loss. The longer Toff, the lower $I_{PK}$.

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

In short circuit or over load condition, VDD can't be charged to $V_{DDREF}$. JW1532N5 will operate in auto-restart mode which is represented in the following description if VDD<$V_{DDREF}$ for some time.

## Auto-restart Mode

JW1532N5 will enter auto-restart mode if SCP/OLP/OTP is triggered. The chip stops switching and the HV power source is disconnected until VDD decreases to $V_{DD\_UVLO}$. If VDD is charged to $V_{DD\_ST}$ for several cycles, the system restarts.

## Over Temperature Protection

When internal temperature of the chip exceeds 150°C, JW1532N5 operates in auto-restart mode to help the chip cooling.

## PCB Design

1. The VDD pin must be locally bypassed with a capacitor.
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.*

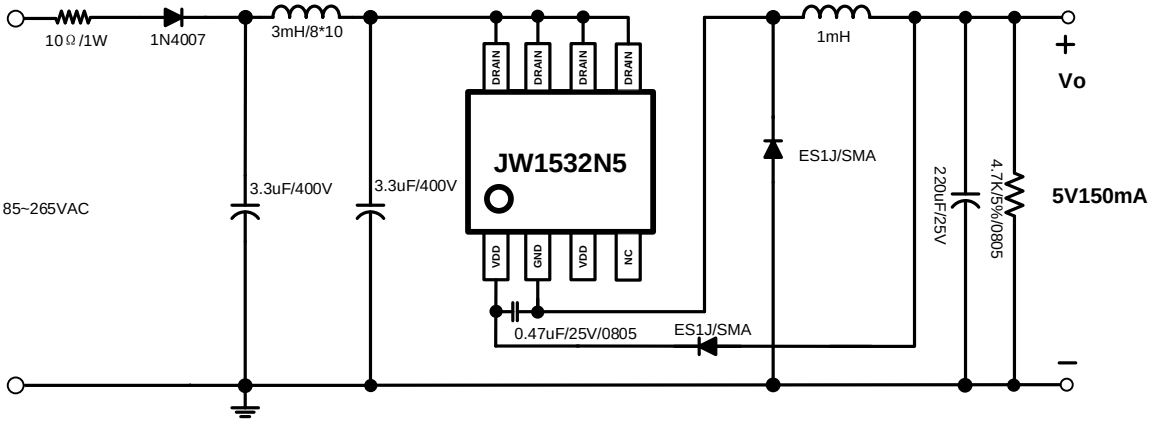
### Reference:

The reference design is suitable for non-isolated buck power supply default 5V output, using JW1532N5.

$V_{IN}$: 85~265VAC

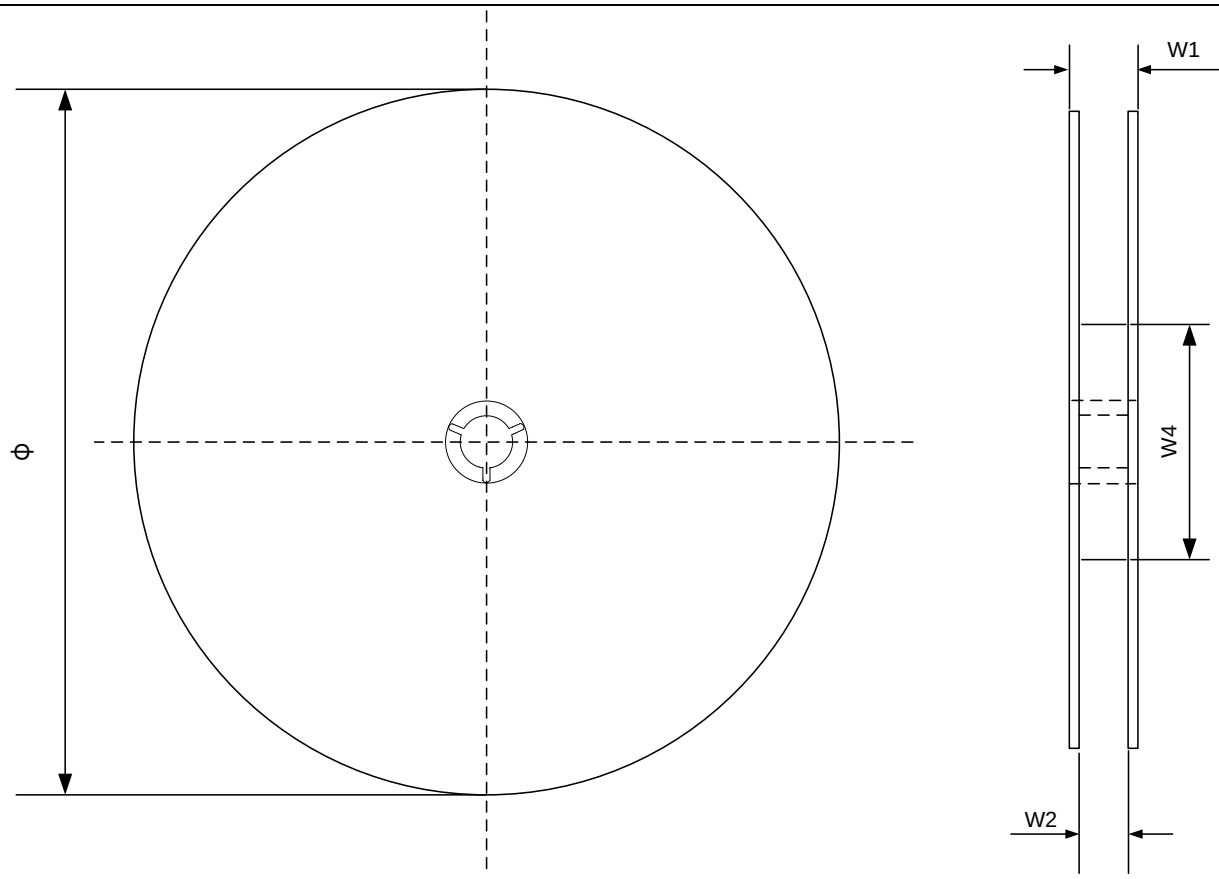
$V_{OUT}$: 5V

$I_{OUT}$: 150mA



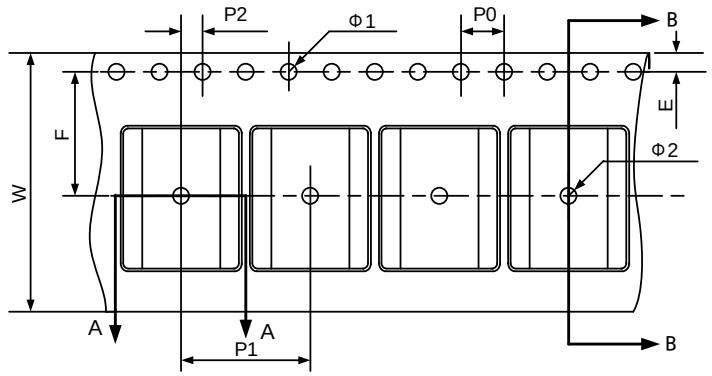
## TAPE AND REEL INFORMATION

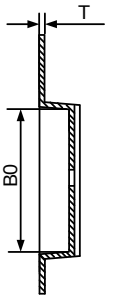
Reel UNIT: mm



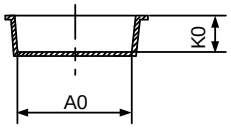

| Package | Diameter Φ | Thickness W1 | Width W2 | W4 |
|---|---|---|---|---|
| SOP8 | 330±2 | 17.6±2 | 12.4±2 | 100±2 |

Carrier Tape UNIT: mm




SECTION B-B




SECTION A-A

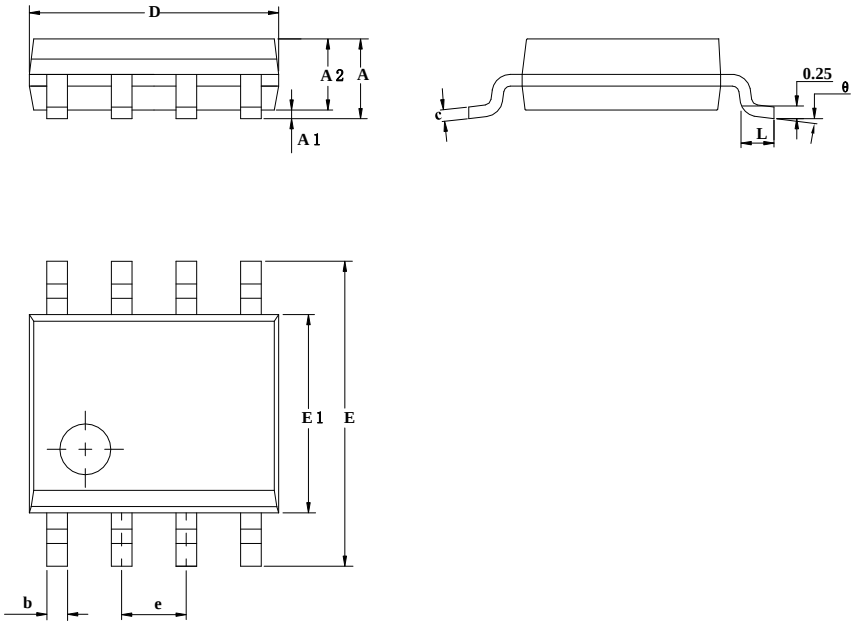
Note :

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 | Tape dimension (mm) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | P0 | P2 | P1 | A0 | B0 | W | T | K0 | Φ1 | Φ2 | E | F |
| SOP8 | 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

SOP8 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° |

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