

*Parameters Subject to Change Without Notice*

## DESCRIPTION

The JW<sup>®</sup>5066 is a monolithic buck switching regulator based on I<sup>2</sup> architecture for fast transient response. Operating with an input range of 4V~18V, JW5066 delivers 6A 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.

JW5066 guarantees robustness with output short protection, thermal protection, current run-away protection, and input under voltage lockout.

JW5066 is available in both ESOP8 and TSOT23-6 packages, which provide a compact solution with minimal external components.

Company's Logo is Protected, "JW" and "JOULWATT" are Registered Trademarks of JoulWatt technology Inc.

## FEATURES

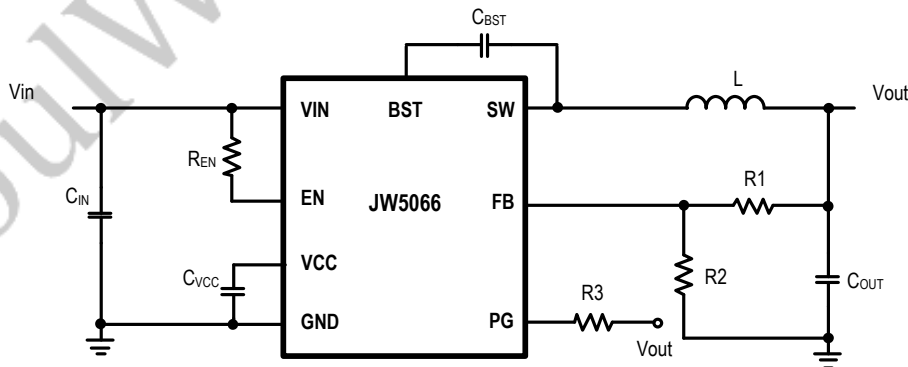
- 4V to 18V operating input range
- 6A output current
- Up to 95% efficiency
- 650kHz switching frequency
- Internal/External (optional) soft-start
- Power good function (optional)
- FCCM/PFM selectable (optional)
- Output short protection
- Thermal protection
- Available in ESOP8 and TSOT23-6 packages

## APPLICATIONS

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

## TYPICAL APPLICATION

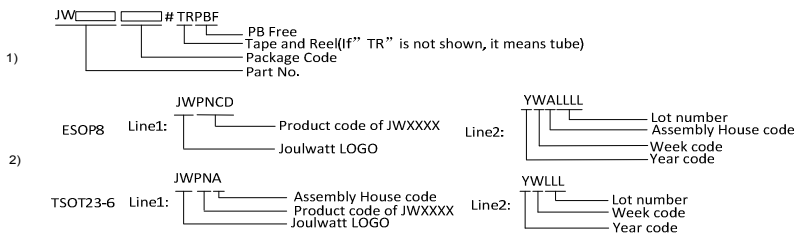
18V/6A Step Down Regulator



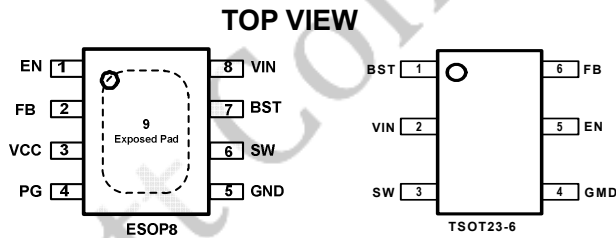
**ORDER INFORMATION**

DEVICE <sup>1)</sup>	PACKAGE	TOP MARKING <sup>2)</sup>
JW5066ESOP#TRPBF	ESOP8	JW5066 YWALLL
JW5066TSOB#TRPBF	TSOT23-6	JW6KX YWLL

**Notes:**



**PIN CONFIGURATION**



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

VIN, EN, SW, MODE* Pin.....	-0.3V to 20V
BST Pin .....	SW-0.3V to SW+5V
All other Pins .....	-0.3V to 6V
Junction Temp. <sup>2) 3)</sup> .....	150°C
Lead Temperature .....	260°C
ESD Susceptibility (Human Body Model) .....	2kV

**RECOMMENDED OPERATING CONDITIONS**

Input Voltage VIN .....	4V to 18V
Output Voltage Vout .....	0.8V to VIN-3V

**THERMAL PERFORMANCE<sup>4)</sup>**

	$\theta_{JA}$	$\theta_{JC}$
ESOP8.....	50	10°C/W
TSOT23-6.....	110	55°C/W

**Note:**

- 1) Exceeding these ratings may damage the device.
- 2) The JW5066 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.
- 3) The JW5066 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.
- 4) Measured on Joulwatt Evaluation Board.

JoulWatt Confidential

**ELECTRICAL CHARACTERISTICS**

*V<sub>IN</sub>=12V, T<sub>A</sub>=25 °C, Unless otherwise stated.*

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
V <sub>IN</sub> Under Voltage Lock-out Threshold	V <sub>IN_MIN</sub>	V <sub>IN</sub> rising		3.7		V
V <sub>IN</sub> Under voltage Lockout Hysteresis	V <sub>IN_MIN_HYST</sub>			200		mV
Shutdown Current	I <sub>SD</sub>	V <sub>EN</sub> =0V			1	μA
Quiescent Current	I <sub>Q</sub>	V <sub>EN</sub> =5V, V <sub>FB</sub> =1.2V		160		μA
Feedback Voltage	V <sub>FB</sub>	4V<V <sub>IN</sub> <18V	758	765	772	mV
Output Discharge Resistance	R <sub>DIS</sub>		-	50	100	Ω
Top Switch Resistance <sup>5)</sup>	R <sub>D(S)ON(T)</sub>	TSOT23-6		20		mΩ
Bottom Switch Resistance <sup>5)</sup>	R <sub>D(S)ON(B)</sub>	TSOT23-6		10		mΩ
Top Switch Leakage Current	I <sub>LEAK_TOP</sub>	V <sub>IN</sub> =18V, V <sub>EN</sub> =0V, V <sub>SW</sub> =0V			1	μA
Bottom Switch Leakage Current	I <sub>LEAK_BOT</sub>	V <sub>IN</sub> =18V, V <sub>EN</sub> =0V, V <sub>SW</sub> =18V			1	μA
Bottom Switch Current Limit	I <sub>LIM_TOP</sub>		6	8	10	A
*Negative Current Limit	I <sub>LIM_NEG</sub>			4		A
Minimum On Time <sup>5)</sup>	T <sub>ON_MIN</sub>			100		ns
Minimum Off Time <sup>5)</sup>	T <sub>OFF_MIN</sub>	V <sub>FB</sub> =0.4V		100		ns
EN Rising threshold	V <sub>EN_H</sub>	V <sub>EN</sub> rising	1.6			V
EN Falling threshold	V <sub>EN_L</sub>	V <sub>EN</sub> falling			0.5	V
*Mode logic threshold	V <sub>MODE_H</sub>		V <sub>IN</sub> -0.5			V
	V <sub>MODE_L</sub>				0.5	V
*Soft-Start Charge Current <sup>5)</sup>	I <sub>SS</sub>			6		uA
*Soft-Start Time <sup>5)</sup>	t <sub>SS</sub>	No SS capacitor		1.6		ms
*Power good threshold	PG <sub>TH</sub>	FB rising	85%	90%	95%	
		FB falling		85%		
*Power good delay <sup>5)</sup>	PG <sub>DLY</sub>	PG from low to high		1		ms
*Power goof sink current	I <sub>PG</sub>	PG=0.5V	2.5	5		mA
Thermal Shutdown <sup>5)</sup>	T <sub>TSD</sub>			150		°C
Thermal Shutdown hysteresis <sup>5)</sup>	T <sub>TSD_HYST</sub>			15		°C

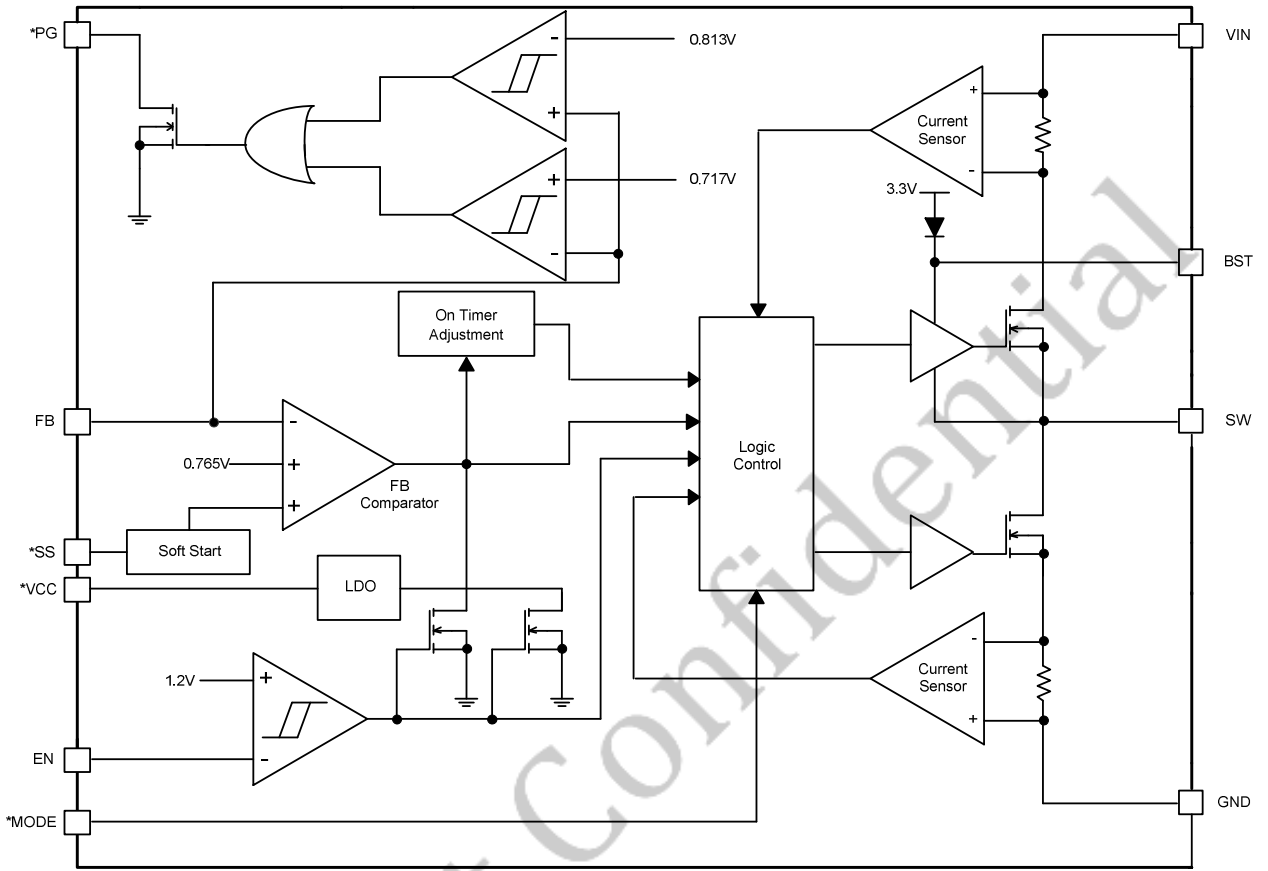
**Note:**

- 5) Guaranteed by design.
- 6) \* means optional function.

**PIN DESCRIPTION**

Pin ESOP8	Pin TSOT23-6	Name	Description
7	1	BST	Connect a 0.1uF capacitor between BST and SW pin to supply current for the top switch driver.
8	2	VIN	Input voltage pin. VIN supplies power to the IC. Connect a 4V to 18V supply to VIN and bypass VIN to GND with a suitably large capacitor to eliminate noise on the input to the IC.
6	3	SW	SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load.
5	4	GND	Power ground pin
1	5	EN	Drive EN pin high to turn on the regulator and low to turn off the regulator.
2	6	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.
3		*VCC	Supply input for analog functions. Bypass VCC to AGND with a 1uF~10uF ceramic capacitor.
4		*PG	Power good monitor output. This is an open-drain output so a resistor should be connected at this pin to the VCC pin or Vout node.
4		*SS	Soft-Start Time setting. Connect an external capacitor between this pin and GND to set the soft-start time.
4		*MODE	Pull MODE pin low to GND to achieve FCC operation. Pull MODE up to VIN to achieve DCM operation.

BLOCK DIAGRAM



## FUNCTIONAL DESCRIPTION

JW5066 is a synchronous step-down regulator based on I2 control architecture. It regulates input voltages from 4V to 18V down to an output voltage as low as 0.8V, and is capable of supplying up to 6A of load current.

### Shut-Down Mode

JW5066 shuts down when voltage at EN pin is driven below 0.3V. The entire regulator is off and the supply current consumed by JW5066 drops below 1 $\mu$ A.

### Power Switch

N-Channel MOSFET switches are integrated on the JW5066 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 3.7V rail when SW is low.

### PFM Mode/FCC Mode

Both PFM mode and FCC mode are integrated on JW5066, and the operation mode can be selected by MODE pin. When MODE pin is pulled up to high, JW5066 operates in PFM mode at light load. In PFM mode, switch frequency decreases when load current drops to boost power efficiency at light load by reducing switch-loss, while switch frequency increases when load current rises, minimizing output voltage ripples.

When MODE pin is pulled low to GND, JW5066 operates in FCC mode at all load range. In FCC mode, switch frequency keeps constant to prevent low frequency interference.

### Internal/External Soft-Start.

Soft-Start makes output voltage rising smoothly

follow an internal SS voltage until SS voltage is higher than the internal reference voltage. It can prevent overshoot of output voltage when startup. The soft-start time can be set by connecting a capacitor between SS pin and GND pin, and the default value is 1.6ms.

### 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 2V to trigger input under voltage lockout protection.

### 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 inductor can be easily built up, resulting in a large start-up output current.

A valley current limit is designed in JW5066 so that only when output current drops below the valley current limit can the top power switch be turned on. By such control mechanism, the output current at start-up is well controlled.

### Output Short Protection

When the output is shorted to ground, the regulator is allowed to switch for 1024 cycles. If the short condition is cleared within this period, then the regulator resumes normal operation. If the short condition is still present after 1024 switching cycles, then no switching is allowed and the regulator enters hiccup mode for 2048 cycles. After the 2048 hiccup cycles, the regulator will try to start-up again. If the short condition still exists after 1024 cycles of switching, the regulator enters hiccup mode. This process of start-up and hiccup iterate itself until the short condition is removed.

**Power Good**

The power good function is activated after soft start has finished. When the output voltage becomes within -10% of the target value, internal comparators detect power good state and the power good signal becomes high. The power good output, PG is an open drain output. If the FB voltage goes under 15% of the target value, the power good signal becomes low. The resistance value which is connected between PG and Vout or VCC is required from 25kΩ to 150kΩ.

**FB SCP**

When FB voltage is detected to be lower than 100mV after soft start is finished, JW5066 stops switching until the short condition is removed.

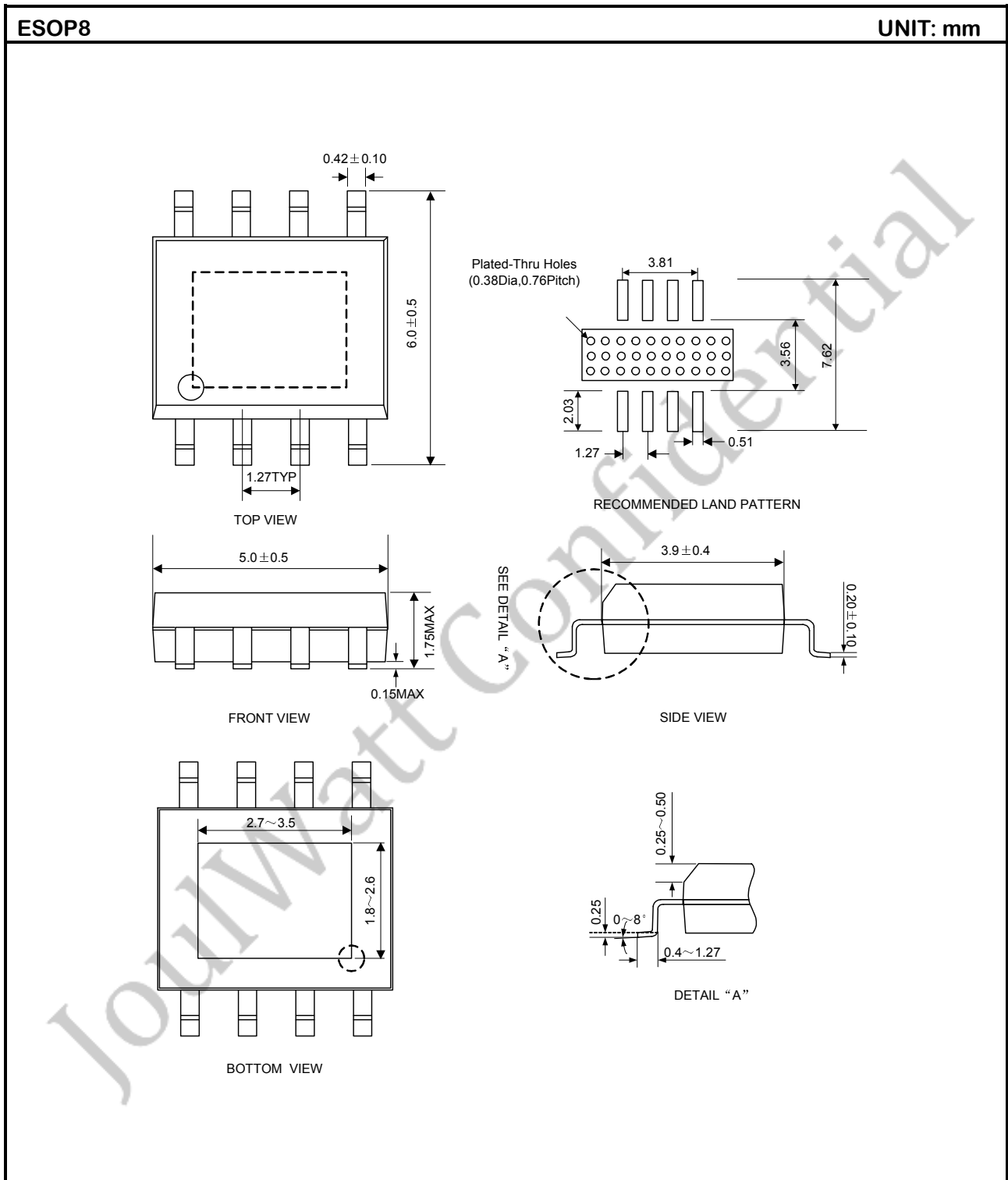
**Thermal Protection**

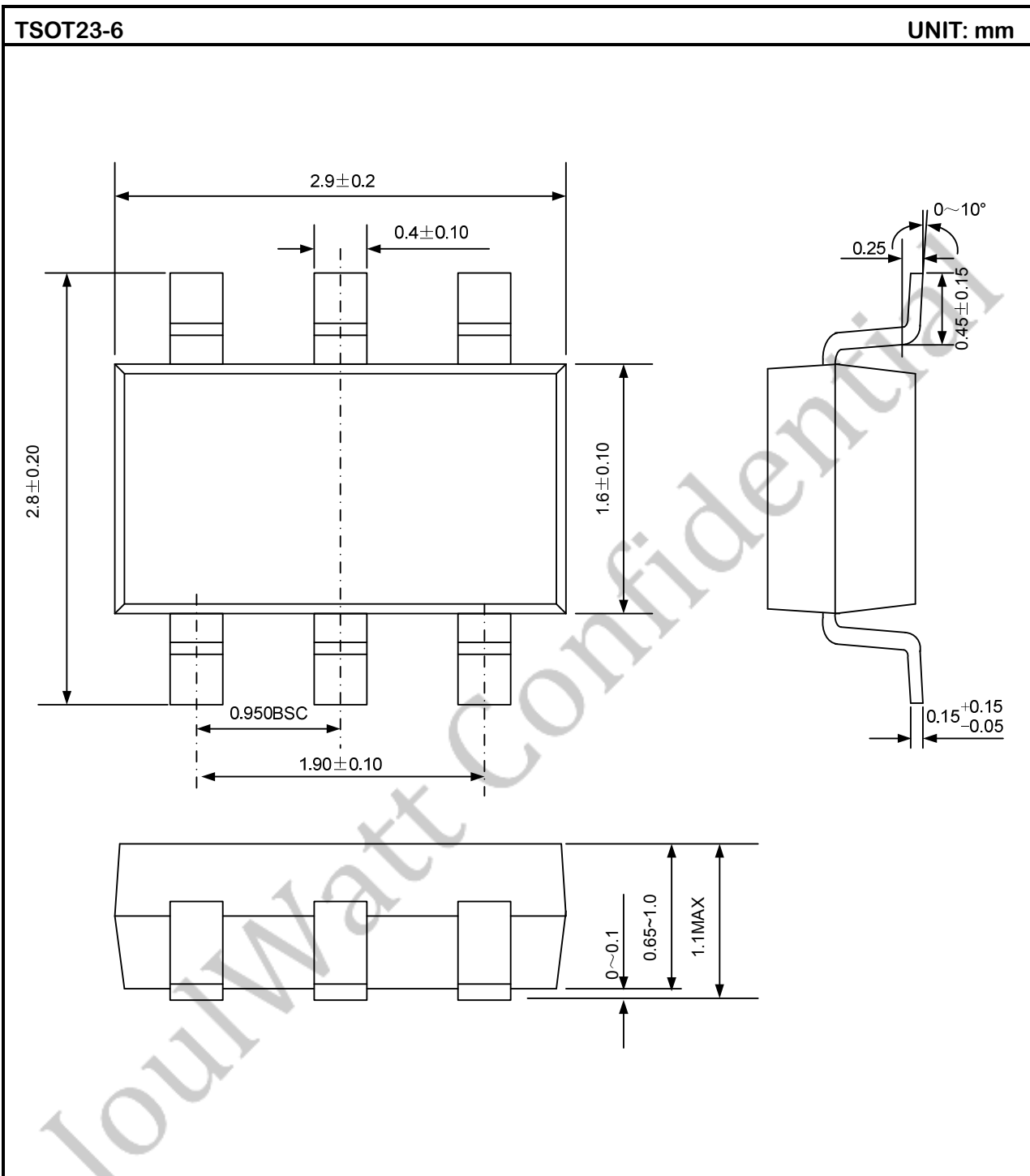
When the temperature of the JW5066 rises above 140°C, it is forced into thermal shut-down. Only when core temperature drops below 125°C can the regulator becomes active again.

JoulWatt Confidential



PACKAGE OUTLINE





**IMPORTANT NOTICE**

- Joulwatt Technology Inc. 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 Inc. does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

JoulWatt Confidential

*Copyright © 2017 JW5066 Incorporated.*

*All rights are reserved by Joulwatt Technology Inc.*