JW5710

Ultra-Low Quiescent Current Synchronous Step-Down Converter

Preliminary Specifications Subject to Change without Notice

DESCRIPTION

The JW®5710 provides an ultra low power solution for products powered by either two rechargeable Li-Ion batteries, Li-primary battery chemistries such as Li-MnO2 or four to six cell alkaline batteries. JW5710 contains a 400nA ultra low Iq synchronous buck converter, an internal input voltage switch and a slew rate controlled load switch. The output voltage of the buck converter is set with four VSEL pins between 1.8V and 3.3V. JW5710 features low output ripple voltage and low noise with a small output capacitor. JW5710 has a 100mA load switch between VOUT and LOAD pin with a typical-On-resistance of 1Ω. The load switch is typically used to distribute the buck converter output voltage to the sub-system.

JW5710 is available in DFN3X2-12 package, which provide a compact solution with minimal external components.

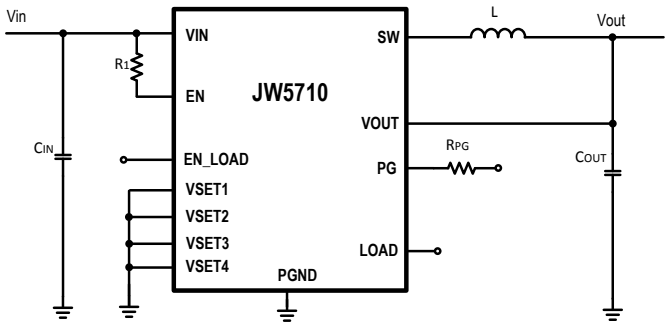
FEATURES

- 3.3V to 10V operating input range
- 400mA continuous / 550mA peak output current
- Typical 400nA quiescent current
- Up to 90% efficiency with load current>15uA
- Low output ripple voltage
- 16 selectable output voltages from 1.8V-3.3V
- Power good indicator
- Integrated load switch
- Input under voltage lockout
- Output short protection
- Thermal protection
- Available in DFN3X2-12 package

APPLICATIONS

- IOT
- Wearable and Personal Electronics
- Health Monitoring and Medical Accessories
- Industrial Metering
- Energy Harvesting

TYPICAL APPLICATION



ORDER INFORMATION

DEVICE[1)]	PACKAGE	TOP MARKING[2)]
JW5710DFNP#TRPBF	DFN3X2-12	JWK5□ YW□□□

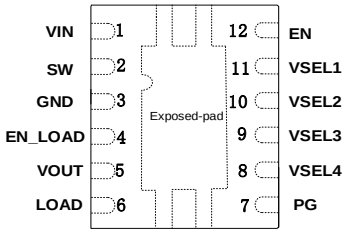
Notes:

1) JW□□ # TRPBF
- PB Free
- Tape and Reel(If" TR" is not shown, it means tube)
- Package Code
- Part No.

2) Line1: JW□□□
- Internal control code
- Product code
- Joulwatt LOGO

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

PIN CONFIGURATION



DFN3mmX2mm

ABSOLUTE MAXIMUM RATING[1)]

VIN, EN, SW Pin ..... -0.3V to 12V
All other Pins ..... -0.3V to 6V
Junction Temp. [2)] 150ºC
Lead Temperature 260ºC
Storage Temperature.....-65 ºC to +150 ºC
ESD (HBM) 2kV
ESD (CDM) 500V

RECOMMENDED OPERATING CONDITIONS[3)]

Input Voltage VIN 3.3V to10V
Output Current Iout 400mA

THERMAL PERFORMANCE[4)]

	θ_{JA}	θ_{Jc}
DFN3X2-12	62	7.2ºC/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 JW5710 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

VIN=6V, T_A=25℃, Unless otherwise stated。

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
V_{IN} Under-voltage Lockout Threshold	V_{IN_MIN}	V_{IN} rising		3.1		V
V_{IN} Under-voltage Lockout Hysteresis	$V_{IN\_MIN\_HYST}$			200		mV
Shutdown Supply Current	I_{SD}	V_{EN}=0V			1000	nA
Supply Current	I_Q	device not switching			1900	nA
High Side MOSFET On-resistance[5)]	$R_{DS(ON)T}$			0.6		mΩ
Low Side MOSFET On-resistance[5)]	$R_{DS(ON)B}$			0.5		mΩ
High Side MOSFET Switch Current Limit	I_{LIM_Peak}	3.6V≤V_{IN}≤10V, Device not in soft start		600		mA
Low Side MOSFET Switch Current Limit	I_{LIM_Valley}	3.6V≤V_{IN}≤10V, Device not in soft start		600		mA
Output Discharge Resistance[5)]	R_{DISCH}			25		Ω
Load Switch On-resistance[5)]	$R_{DS(ON)LS}$			1		Ω
Load Switch Discharge Resistance[5)]	$R_{DS(ON)VINS}$			50		Ω
Power Good Threshold Voltage	V_{TH_PG}	Rising output voltage on VOUT pin		95		%
Power Good Threshold Hysteresis	$V_{TH\_PG\_HYS}$			5		%
Power Good Sink Current	I_{PG}		8			mA
Power Good Delay Time	T_{elay}	Response time of PGOOD circuit		200		us
Minimum On Time[5)]	T_{ON_MIN}	V_{IN}=6V, V_{OUT}=2V		250		ns
Minimum Off Time[5)]	T_{OFF_MIN}	V_{IN}=3.3V		50		ns
Soft-start Time[5)]	T_{SS}			1		ms
EN High-level Input Voltage	$V_{EN\_H\_TH}$	V_{IN_MIN} ≤V_{IN}≤10V	1.2			V
EN Low-level Input Voltage	$V_{EN\_L\_TH}$	V_{IN_MIN} ≤V_{IN}≤10V			0.3	V
Thermal Shutdown[5)]	T_{TSD}			150		° C
Thermal Shutdown hysteresis[5)]	T_{TSD_HYST}			20		° C

Note：

5) Guaranteed by design.

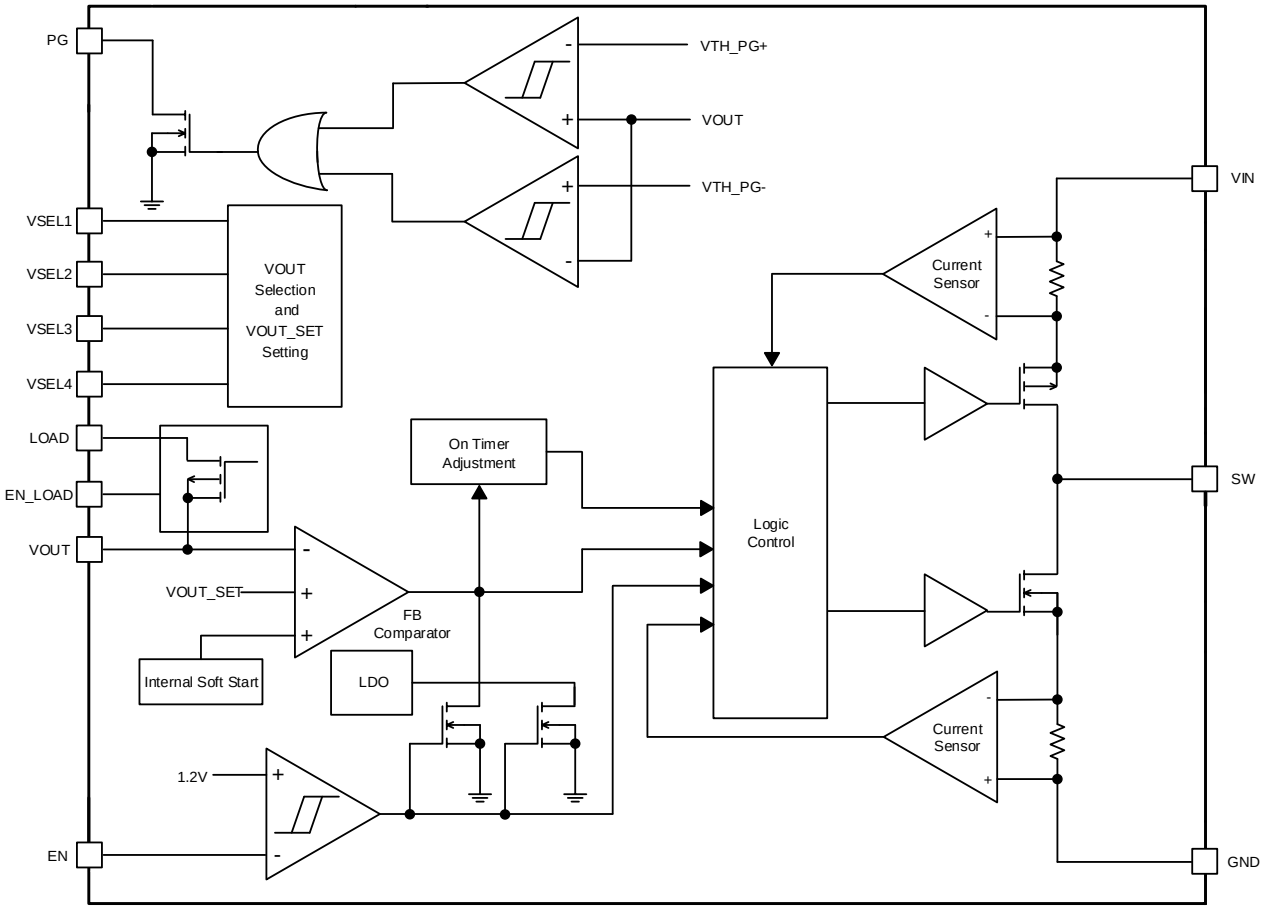
Table 1. Output Voltage Setting For JW5710

VOUT/V	VSEL4	VSEL3	VSEL2	VSEL1
1.8	0	0	0	0
1.9	0	0	0	1
2.0	0	0	1	0
2.1	0	0	1	1
2.2	0	1	0	0
2.3	0	1	0	1
2.4	0	1	1	0
2.5	0	1	1	1
2.6	1	0	0	0
2.7	1	0	0	1
2.8	1	0	1	0
2.9	1	0	1	1
3.0	1	1	0	0
3.1	1	1	0	1
3.2	1	1	1	0
3.3	1	1	1	1

PIN DESCRIPTION

Pin	Name	Description
1	VIN	VIN power supply pin. Connect this pin close to the VIN terminal of the input capacitor. A ceramic capacitor of 4.7μF from this pin to GND is required.
2	SW	Switch pin which is connected to the internal MOSFET switches. Connect inductor to this terminal.
3	GND	Ground pin.
4	EN_LOAD	This pin connects / disconnects the internal load switch from VOUT to LOAD. With EN_LOAD = low, the switch is open. With EN_LOAD= high, the switch is closed connecting VOUT with LOAD. If not used, the pin should be tied to GND.
5	VOUT	Feedback pin for the internal feedback divider network and regulation loop. Connect this pin directly to the output capacitor with a short trace.
6	LOAD	Output of load switch connecting VOUT to LOAD when EN_LOAD=high. If not used, leave this pin open.
7	PG	This is an open drain power good output.
8	VSEL4	Output voltage selection pins.
9	VSEL3	
10	VSEL2	
11	VSEL1	
12	EN	Enable pin. Drive EN pin high to turn on the regulator and low to turn off the regulator.

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

JW5710 is a dual-cell ultra low power synchronous step-down regulator. It regulates input voltages from 3.3V to 10V down to an output voltage range from 1.8V to 3.3V with ultra low quiescent current consumption (400nA typical) and is capable of supplying up to 400mA continuous, 550mA peak load current.

Shut-Down Mode

JW5710 shuts down when voltage at EN pin is driven below 0.3V. The entire regulator is off and the supply current consumed by JW5710 drops below 1uA (130nA typical).

Output Voltage Selection

JW5710 does not require an external resistor divider network to program the output voltage. The device integrates a high impedance feedback resistor divider network which is programmed by VSEL1-4 pins.JW5710 supports an output voltage range of 1.8V to 3.3V. The output voltage can be changed during operation and supports simple dynamic output voltage scaling. The output voltage is programmed according to Table 1.

Soft Start

The JW5710 has an internal soft-start function to prevent large inrush current and output voltage overshoot when the converter starts up. The soft-start automatically begins once the chip is enabled. During soft-start, it clamps the ramping of internal reference voltage which is compared with VOUT signal. The typical soft-start duration is 1ms.

Power Good Indicator

The JW5710 has power-good (PG) output. The PG pin is the open drain of a MOSFET. Connect to VOUT or another voltage source through a resistor. When the output voltage becomes within -5% of the target value, internal comparators detect power good state and the power good signal becomes high. If the output voltage goes under 10%of the target value, the power good signal becomes low. The power good signal is as well as pulled to low level in case the input voltage falls below the under-voltage threshold or the device is disabled with EN=low. With EN=high, once the load current falls below 1mA, the output of power good indicator is driven to high impedance state and the PG comparator is turned off to achieve lowest quiescent current. PG will be triggered when an output voltage change is ongoing due to a change in VSEL pin levels if the new target is high enough to trigger the PG threshold.

Output Current Run-Away Protection

JW5710 ingrates a current limit on the high side as well on the low side MOSFETs to protect the device against overload or short circuit conditions. The peak current in the switches is monitored cycle by cycle. If the high side MOSFET current limit is reached, the high side MOSFET is turned off and the low side MOSFET is turned on until the current decreases below the low side MOSFET current limit.

Output Discharge

The device provides automatic output voltage discharge once it is disabled. This feature prevents residual charge voltage on the output capacitor, which may impact proper power up of the system connected to the converter. The discharge circuit at VOUT pin becomes active

once the EN pin is pulled to low or the input voltage drops below UVLO comparator threshold.

Load Switch

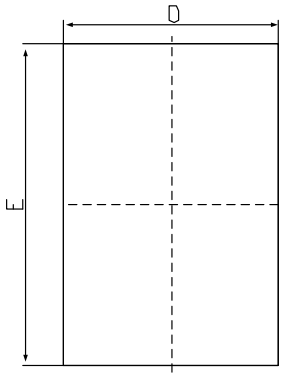
The JW5710 integrates a 100mA load switch. The load switch connects VOUT pin to the LOAD pin and the on-resistance depends on the output voltage. At 1.8V Vout, the on resistance is maximum 1.2Ω. The load switch can be used to power a sub-system controlled by EN_LOAD pin. To avoid a voltage drop at the output of the buck converter the load switch has a internal soft-start. With EN_LOAD=low the load switch is turned off and the LOAD pin is internally discharged to GND by typically 50Ω. This makes sure the output of the load switch is always discharged to GND before the load switch is turned on again.

Thermal Protection

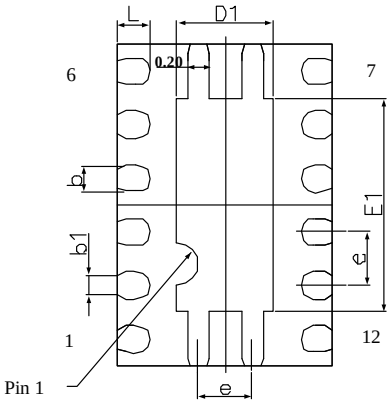
When the temperature of the JW5710 rises above 150°C, it is forced into thermal shut-down. Only when core temperature drops below 130°C can the regulator becomes active again.

PACKAGE OUTLINE

DFN3X2-12 UNIT: mm

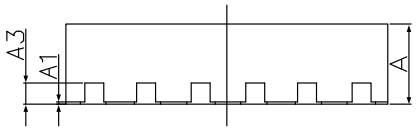


TOP VIEW



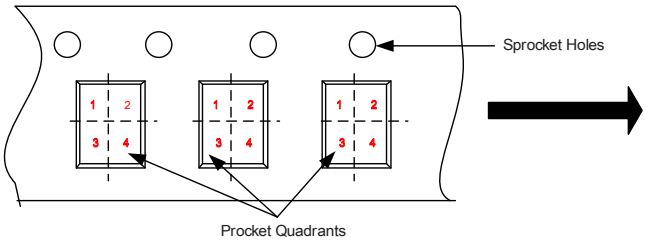
BOTTOM VIEW

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	—	0.05
A3	0.20REF		
D	1.90	2.00	2.10
E	2.90	3.00	3.10
D1	0.80	0.90	1.00
E1	1.90	2.00	2.10
b	0.20	0.25	0.30
b1	0.18REF		
e	0.50BCS		
L	0.25	—	0.35



SIDE VIEW

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPAE



Package Type	Pin1 Quadrant
DFN3X2-12	1

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