## DESCRIPTION

HSY8120B1ABC is awide input range, high-efficiency and high frequency DC-to-DC step-down switching regulator, capable of delivering up to 2A of output current. With a fixed switching frequency of 500KHz, this current mode PWM controlled converter allowsthe use ofsmall external components,suchas ceramic input and output caps, as well as small inductors.

HSY8120B1ABC also employs a proprietary control scheme that switches the device into a power save mode during light load, thereby extending the range of high efficiency op eration.An OVP function protects the IC itself and its downstream system against input voltage surges. With this OVP function, the IC can stand off input voltage as high as 19V, making it an ideal solution for industrial applicationssuch as LCDTV, Set Top Box,Portable TV, etc.

HSY8120B1ABC is available in SOT-23-6L package.

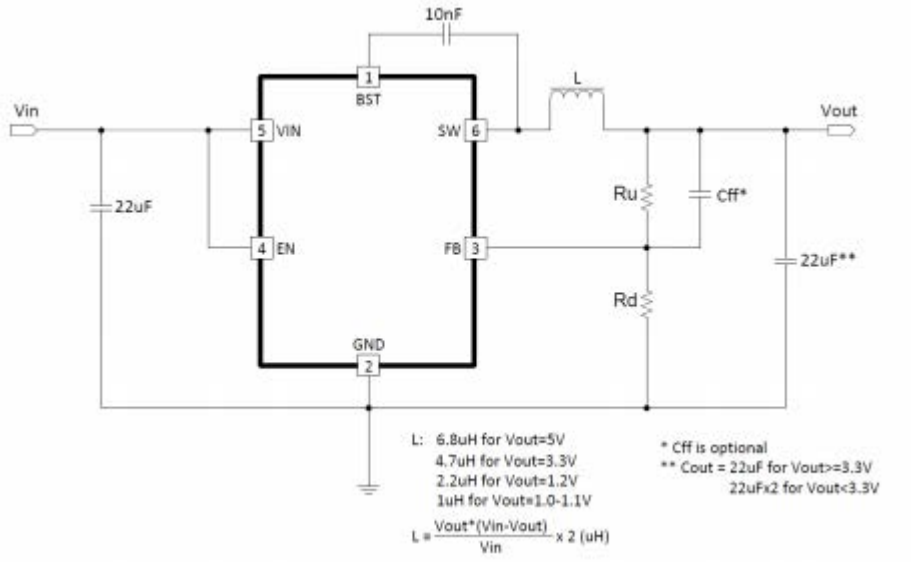
## FEATURES

- Wide Input Range: 4.2V-18V
- High Efficiency PFM mode at light load
- Capable of Delivering 2A
- No External Compensation Needed
- Current Mode Control
- Thermal Shutdown and UVLO
- Excellent Load and Line Transient ResponseAvailable in SOT23-6 Package

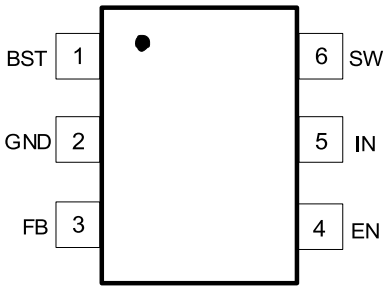
## APPLICATIONS

- LCD TV
- Set Top Box
- Portable TV

## TYPICAL APPLICATION



## PIN CONFIGURATION




SOT-23-6L

## ABSOLUTEMAXIMUM RATINGS

(Note: Exceeding these limits maydamage the device. Exposure to absolute maximum rating conditions for long periods mayaffect device reliability.)

IN,SW,ENVoltage .....-0.3V to 19V
BST Voltage .....-0.3V to SW+6V
FB Voltage .....-0.3V to 6V
Operating Temperature Range .....-40°C to 85°C
Storage Temperature Range .....-55°C to 150°C

| Thermal Resistance | $\theta_{JA}$ | $\theta_{JC}$ | |
|---|---|---|---|
| SOT-23-6L | 180 | 90 | °C/W |

Lead Temperature (Soldering 10ssec) .....260°C
ESD HBM (Human Body Mode).....2KV
ESD MM (Machine Mode).....200V

## PIN DESCRIPTION

| PIN # | NAME | DESCRIPTION |
|---|---|---|
| 1 | BST | Bootstrap pin. Connect a 10nF capacitor from this pin to SW |
| 2 | GND | Ground |
| 3 | FB | Feedback Input. Connect an external resistor divider from the output to FB and GND to set $V_{OUT}$ |
| 4 | EN | Enable pin for the IC. Drive this pin high to enable the part, low to disable. |
| 5 | VIN | Supply Voltage. Bypass with a 4.7μFceramic capacitor to GND |
| 6 | SW | Inductor Connection. Connect an inductor Between SW and the regulator output. |

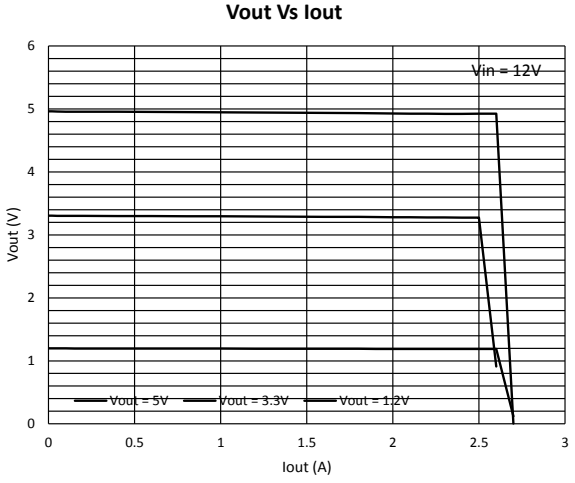
## ELECTRICAL CHACRACTERISTICS

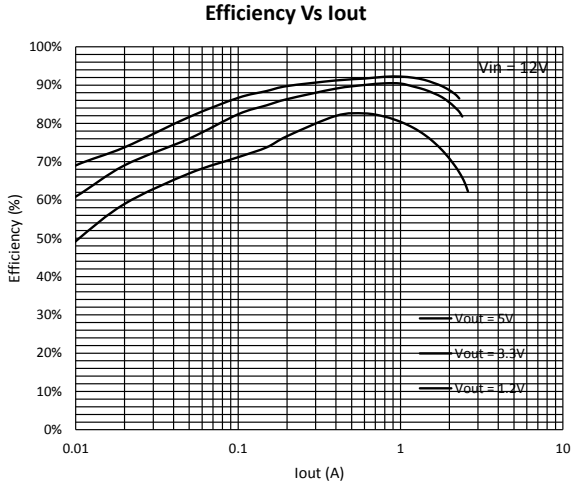
($V_{IN}$= 12V, $V_{OUT}$= 3.3V, unlessotherwise specified. Typical values are at TA = 25°C.)

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Input Voltage Range | | 4.2 | | 18 | V |
| Input UVLO | Rising, Hysteresis=340mV | | 4.2 | | V |
| Input OVP | Rising, Hysteresis=1V | | 19 | | V |
| Input Supply Current | $V_{FB}$=0.65V | | 700 | | μA |
| Input ShutdownCurrent | | | 7 | 14 | μA |
| FB Voltage | | 0.588 | 0.6 | 0.612 | V |
| FB Input Current | | | 0 | 1 | μA |
| Switching Frequency | | | 500 | | kHz |
| Maximum Duty Cycle | | | 99 | | % |
| Short Circuit Hiccup Time | On Time | | 2 | | mS |
| | Off Time | | 6 | | mS |
| FB Hiccup Threshold | | | 0.2 | | V |
| High Side Switch On Resistance | | | 160 | | mΩ |
| Low Side Switch On Resistance | | | 95 | | mΩ |
| High Side Current Limit | | | 3.5 | | A |
| SW Leakage Current | IN=SW=12V | | | 20 | μA |
| ENRising Threshold | | | 1.5 | | V |
| EN FallingThreshold | | | 1.3 | | V |
| EN Input Current | $V_{EN}$=2V | | 1 | | uA |
| Thermal Shutdown | Rising, Hysteresis =40°C | | 150 | | ℃ |

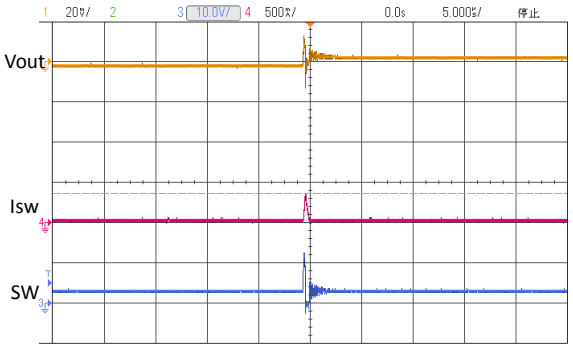
## TYPICAL CHARACTERISTICS

(Typical values are at $T_A$= 25°C unless otherwise specified.)

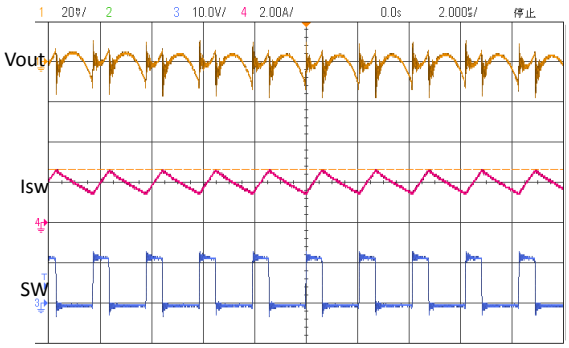


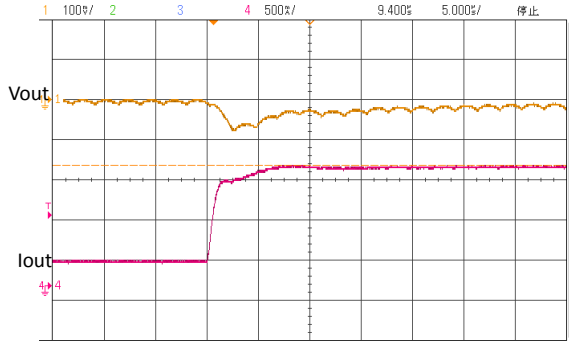
Switching Waveform at Iout = 0A
(Vin=12V, Vout=3.3V)



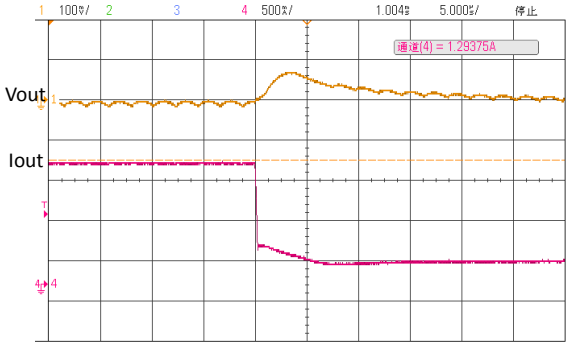

Switching Waveform at Iout = 2A
(Vin=12V, Vout=3.3V)



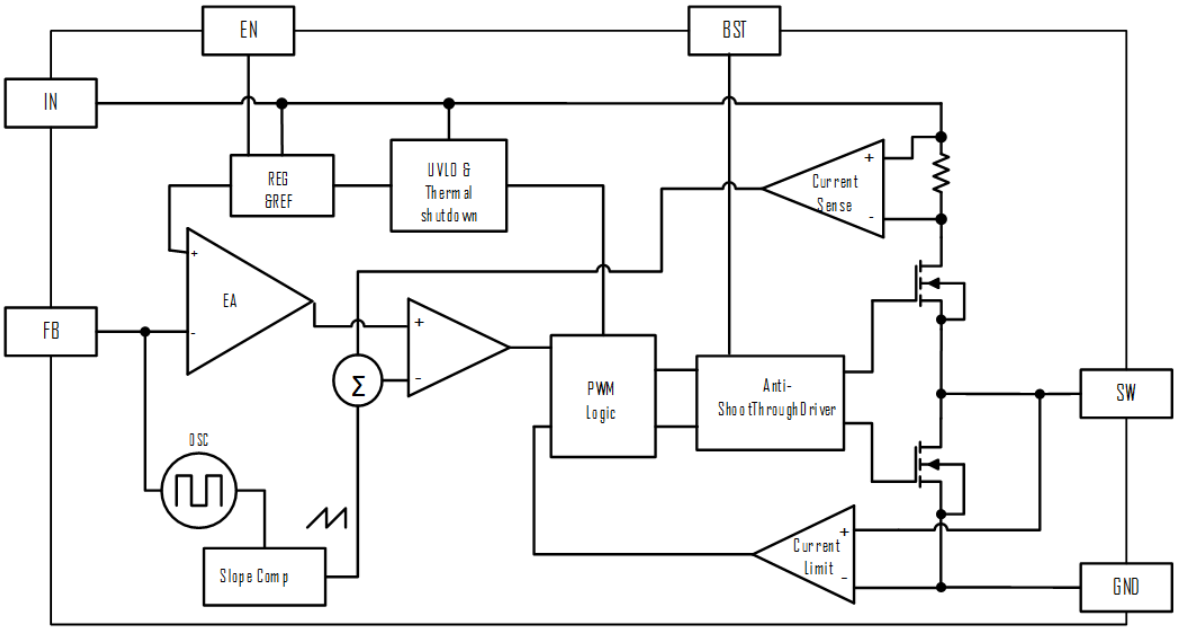

Load Transient Response –Iout Rising Edge 1A/1us
Vin=12V, Vout=1.1V, L=2.2uH, Cout=22uFx2, Iout 0.3-1.5A




Load Transient Response – Iout Falling Edge 1A/0.2us
Vin=12V, Vout=1.1V, L=2.2uH, Cout=22uFx2, Iout 1.5-0.3A




## FUNCTIONAL BLOCK DIAGRAM



# FUNCTIONAL DESCRIPTION

The HSY8120B1ABC is a synchronous buck regulator ICs that integrates the PWM control, top and bottom switches on the same die to minimize the switching transition loss and conduction l

The HSY8120B1ABC is a wide input range, high efficiency, DC-to-DC step-down switching regulator,capable of delivering up to 2A of output current, integratedwith a 160mΩ high side and 95mΩ low side MOSFET. It uses PWM current-mode control scheme. An error amplifier integrates error between the FB signal and the internal reference voltage. The output of the integrator is then compared to the sum of a current-sense signal and the slope compensation ramp. This operation generates a PWM signal that modulates the duty cycle of the power MOSFET to achieve regulation for output voltage.

## Light Load Operation

Traditionally, a fixed constant frequency PWM DC-DC regulator always switches even when theoutput load is small. When energy is shuffling back and forth through the power MOSFET, power is lost due to the finite Rdson of the MOSFET and parasitic capacitances. At light load, this loss is prominent and efficiency is therefore very low. HSY8120B1ABC employs a proprietary control scheme that improves efficiency inthis situation by enabling thendevice into a power save mode during light load, thereby extending the range of high efficiency operation.

## Enable

EN is a digital control pin that turns the HSY8120B1ABC on and off. Drive EN High to turn on the regulator, drive it Low to turnit off. An internal 1MΩ resistor from EN pin to GND allows EN to float to shutdown the chip. Connecting the EN pin through a pull up resistor or shorted EN to IN will automatically turn on the chip whenever plug in IN.

## Over Current Protection and Hiccup

HSY8120B1ABC has a cycle-by-cycle over current limit for when the inductor current peak value is over the set current limit threshold. When the output voltage drop until FB falls below UVthreshold (0.2V), the HSY8120B1ABC will enter hiccup mode. It will turn off the chip immediately for 6mS. After that, it will try to re-starts as normal for 2mS. After 2mS, if FB is still below UV threshold, then the chip enters hiccup mode again. If FB is higher than UV threshold, it will enter the normal mode.

## Over-Temperature Protection

Thermal protection disables the output when the junction temperature rises to approximately 150°C, allowing thedevice to cooldown. When the junction temperature cools to approximately 110°C, the output circuitry is againenabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protectioncircuit may cycle on and off. This cycling limits regulator dissipation, protecting the device from damage as aresult of overheating.

# APPLICATION INFORMATION

## External Output Voltage Setting

In external Output Voltage Setting Version selected,the HSY8120B1ABC regulator is programmed using an external resistor divider. The output voltage is calculated using below equation.

$$V_{OUT} = V_{REF} \times (1 + \frac{R_u}{R_d})$$

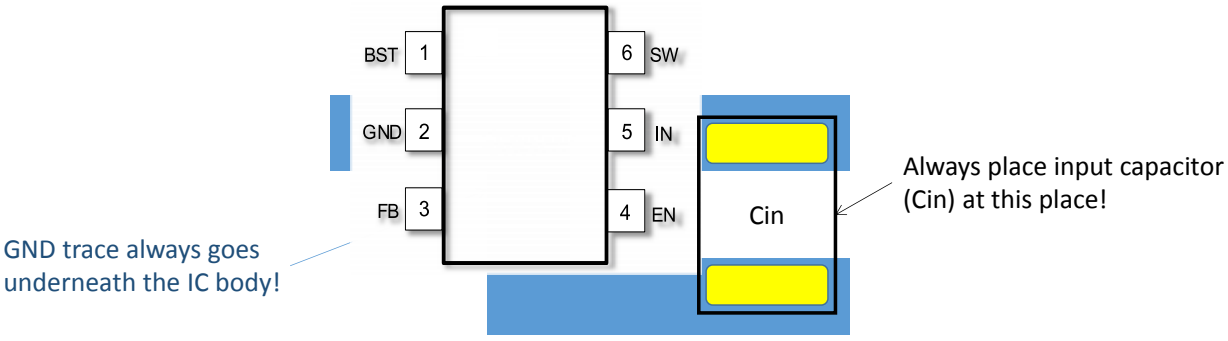
Where:VREF =0.6V typically(theinternal reference voltage)

Resistors Rdhas to be between 1kOhm to 20KOhmand thus Ru is calculated by following equation.

$$R_u = \left(\frac{V_{OUT}}{V_{REF}} - 1\right) \times R_d$$

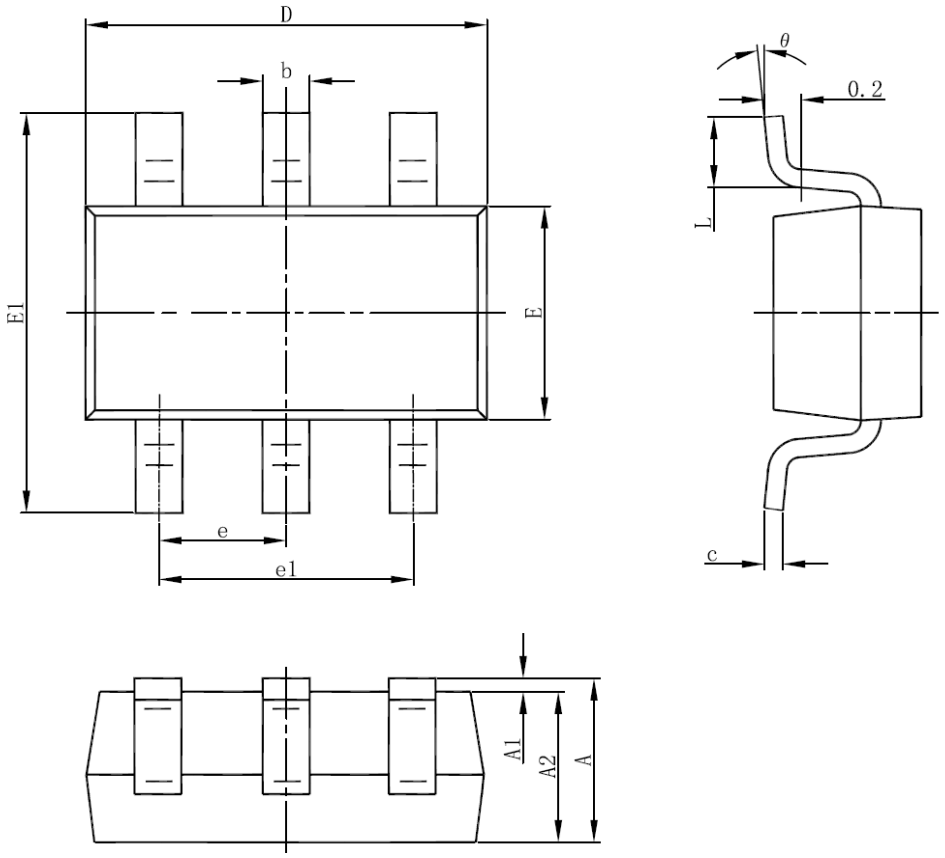
# PCB LAYOUT GUIDE

For any high voltage buck, it is always crucial to have input capacitor placed as close to the chip's IN and GND pin without any via, because the input capacitor is to keep the chip's real input voltage from droppi ng too much when large switching current is drawn from the input node. A simple illustration of how to pla ce input capacitor and draw the trace to the chip's IN and GND pins isshown below, and it is highly reco mmended to strictly follow this guide.



## PACKAGE OUTLINE

Package: SOT-23-6L




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E | 1.500 | 1.700 | 0.059 | 0.067 |
| E1 | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950(BSC) | | 0.037(BSC) | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

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